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A

SYSTEM

OF

HUMAN ANATOMY.

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A SYSTEM OF HUMAN ANATOMY:

TRANSLATED FROM THE FOURTH EDITION OF THE FRENCH OF

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WITH NOTES AND A CORRECTED NOMENCLATURE,

BY

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PREFACE.

The peculiar excellence and merit of British anatomical writers seems to be mainly connected with the originality of the views brought forward in their monographs, and even in their more voluminous systematic works: the extreme accuracy of detail, whenever the subject to be described leads to practical results; the splendid and happy physiological and pathological deductions which abound in their writings; but above all, with the discovery, if I may say so, and perfection of those descriptions of the more important surgical regions of the body, a work begun and finished solely by British anatomists and surgeons.

These seem to me (for I must speak with diffidence, aware of my inherent nationality,) a few of the excellencies which abound in British writers; by their very presence they exclude other good qualities, which, though of a more humble and inferior cast, are yet of the utmost consequence to the anatomical student.

The excellence here alluded to, which we in vain look for in British, and but seldom fail to meet with in Continental writers (so religiously have they copied each other from Winslow to the present day,) is that of presenting to the anatomical student a clear, methodical, and concise, yet minute description of all the parts of the human body, with brief allusions only to the uses of the parts, and with none of those alarming digressions, interlarding and disfiguring the works of English anatomists.

It would indeed be a subject curious in itself and well meriting inquiry, to search into the causes of difference in the character of the British and Continental anatomical writers, and why the former should adhere so generally to the diffuse but original style of Galen, Vesalius, and some others of the older anatomical writers, whilst the latter, rigid copyists of Winslow, should have done nothing but reproduce that great anatomist's works, in style and matter, as if the character of the whole anatomical writers of the nation (as really seems to be the case) had been formed on one model.

And yet with all the contempt one naturally feels for mere copyists, it must be admitted that the model followed by the Continental anatomist is, in many respects, better than our own, and that the diffuse wandering style of Galen and Vesalius, with their monstrously absurd theories and endless repetitions, will not stand a comparison with the concise and energetic manner of Winslow, his mechanical accuracy, and his brief yet perspicuous manner. The actual matter contained in the seven folio volumes of Galen might with ease, and with great advantage, figure in a single modern quarto; and the ponderous folio of Vesalius, if re-written by Winslow, or even by its immortal author, had he lived in modern times, would scarcely fill a single close printed octavo.

In making the remarks I have done on those founders of anatomy and physiology, I hope I shall not be supposed animated with that spirit of hasty and uncandid criticism which is the prevailing fashion. Who would believe that so cautious a writer as Cuvier should have criticised Vesalius erroneously, should have represented him as saying that which he never said, and founded thereon deductions subversive of every feeling of respect for that great name which all anatomists have been taught to venerate? And yet this is true. The French anatomist affirms Vesalius to have given a representation of the fetus and placenta of a quadruped, *knowing it to be such*, for the human fetus and placenta; which assertion is so strangely incorrect, that one is at a loss to explain how it happened to be made by any one; coming, as it does, from the first anatomist of the day, it is inexplicable.

To the class of writers who, adopting Winslow as their model, have founded their expectations of public approbation on the excellency of their writings, as text books, aiming apparently at no higher merit, belong most of the excellent compilations produced on the Continent since that period; the writings indeed of Soemmering, Sabatier, Boyer, Portal, Bichat, Cloquet, and others, leave nothing to be desired as mere descriptions of the anatomy of the human body; and if we deny to them the smallest title to genius or originality, the praise of clearness of description, admirable general perspicuity, happy arrangement, and minute description, cannot possibly be withheld.

In addition to these good qualities, the anatomical writers of whom I now speak pay the greatest attention to *method*. This stamps an additional value on works of purely descriptive anatomy; but, when carried into surgical anatomy, as has been lately attempted by our Continental neighbours and *quondam* rivals, it has occasionally given rise to the most ridiculous results. Soon after the introduction of surgical anatomy into France (which took place in 1815), the subject of surgical anatomy became all at once, like every novelty, a complete *mania;* and *systematic* works on surgical anatomy were got up with incredible rapidity. In these works, every region of the body is deemed of equal surgical importance, and every layer of cellular membrane becomes another *fascia transversalis!* They dispute about the *discovery* of parts which all anatomists have seen since the days of Herophilus; but such is the method and regularity of their works, and so laudably anxious are they that no important or novel consideration should escape them, that Mr. Blandin, (I must choose one specimen), describing all the possible surgical anatomy of, and all the surgical operations which can possibly be performed in and about the head, (which he invariably designates by the imposing philosophic name of "Encephalic extremity of the Trunk"), very gravely, and with the best faith in the world, informs his readers, that "the head cannot be removed by amputation in the living subject without stopping respiration, and producing other inconveniences which render this operation unhappily inadmissible."*

Incredible as it may appear, some of these works have been translated into the English tongue, the translator seemingly wholly unconscious, that by so doing he was merely offering to the public the writings and discoveries in surgical anatomy of Mr. Collis, Mr. Abernethy, Sir Astley Cooper, Mr. Charles Bell, and Mr. Lawrence, in a mangled and depreciated form. But to return.

There is a peculiar feature in the Continental systematic anatomical works, which I cannot pass over without notice. They describe the anatomy of the whole body with equal care, and nearly equal minuteness. They do not presume to prejudge the relative importance of certain regions of the body, and to measure the degree of attention which the student and surgeon should devote to some, and the measure of neglect to other parts of the body.

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* Mr. Blandin ought not to despair: we now know, by accurate experiments made before respectable witnesses, that the human body may be ripped up alive, and yet the person escape; nay even recover. Limbs are hewn off *against time*; if one man amputates at the hip joint, and requires only five minutes for his operation, another boasts of his greater expertness in quartering the body, as he requires only a minute and a half to perform a similar operation; and although the operation should accidentally be unnecessary, and therefore cruel and scandalous, and moreover fatal, he advertises it in the daily newspapers, "that his light may not shine under a bushel." It is said, moreover, that an attempt is to be made to remove the upper jaw in a case of diseased face; now, should the cranium of the patient happen to be furnished after the same fashion as the operator, its removal may possibly be unattended by any bad results. The case may even figure as one of "amputation of the head."

They do not inculcate to their readers that the muscles of the back are altogether unimportant; a minute knowledge of the bones unnecessary; the smaller arteries not worth remembering, and the anatomy of the nerves absolutely useless. These doctrines, wherever or by whomsoever taught, are peculiarly dangerous to the student; if listened to for a moment, they must destroy his views for ever.

There are many persons, indeed, some of them, I regret to say, teachers of anatomy, who seem to think that anatomy in itself is the most tiresome, disgusting, and uninteresting of all studies; and, proceeding on this notion, pregnant with dangerous consequences to the profession and to the science, have taught anatomy as a mere appendage to surgery; and carrying into a liberal profession their own empirical views, have rejected, and anxiously taught others to reject every anatomical fact which did not lead to the "dextrous performance of some cunning and skilful operation in surgery, the execution of which should be most profitable to the surgeon;" or they have compounded it, to use a professional phrase and metaphor, with medicine, physiology, and pathology, as if anatomy were a nauseous draught requiring to be masked by some palatable, overpowering ingredient. And this is the language held of a science, most exact in itself, most interesting and important to the human race, the foundation of the philosophy of living beings, and the only basis on which the superstructure of medicine, surgery, and physiology can be raised.

From facts such as these, persons of great eminence in our profession have not hesitated to declare anatomical science in this country to be at its lowest ebb; but a moment's reflection must show the unprejudiced the extreme inaccuracy of so sweeping a statement.

Systematic compilations or treatises on human anatomy which simply describe the structure, appearance, and general situation of the organs to each other, constitute a species of writing seldom attempted by British writers: and yet these are of all others, the kind of works most essential to the student in anatomy; or rather, I should say, to him indispensable. Our manuals for the use of the dissecting room, so admirable for the details of surgical anatomy, are generally vague, deficient, and not unfrequently incorrect in their descriptions of many parts of the body. Our systematic works seem avowedly written as much for amusement as for instruction, so numerous and extraordinary are the digressions they contain. But whether or not these criticisms be strictly just, I felt I could not possibly dismiss from my mind that important truth, that works conceived and executed after the model of Winslow, Sabatier, Portal, Soemmering, and others, do not exist in the English language; a truth daily obtruded on me by my duties as a teacher of anatomy, and unhappily annually giving rise to the statement required to be made by me to one of the most numerous classes of anatomical students with which the public has ever honoured any individual, namely, that the text book of my lectures must be selected from amongst a class of authors infinitely inferior in genius, but superior in method and good taste to those of my country.

The inconvenience attending the teaching anatomy from a text book written in a foreign language induced me to compare very carefully the works of the authors to whom I have so frequently alluded throughout these preliminary observations, with nature, with each other, and with the various monographs which are the peculiar and exclusive product of no nation, but belong alike to all. They have appeared to me to possess few advantages over each other; and indeed how could they, since they are at best but copies and compilations? The extremely popular and well written work of Mr. Cloquet yields to none of its predecessors either in style or matter, and has been selected by me with the concurrence of my publishers, as a book deserving translation, and admirably adapted to become the text book of an anatomical course, and a faithful guide to the student in the dissecting room. As the translation now offered to the public was undertaken solely for the accommodation of my pupils, I do not mean to say any thing farther in commendation of the original; and yet it is but rendering justice to Mr. Cloquet's treatise, when I affirm, that no better anatomical work has ever been offered to the public.

With regard to the style of the original and of the translation, I have few remarks to make; Mr. Cloquet's style is concise and most perspicuous: his descriptions lively and agreeable; seldom laboured. His omission of what is called general anatomy, with all its absurd theories, its tiresome diffuseness, its verbosity and unprofitable minuteness, ought to be deemed by the student a great advantage and a recommendation of the work; and should any one doubt this, let him peruse the first volume of the "Manuel d'Anatomie generale, descriptivè et pathologique, by J. F. Meckel," where he will find under the title "General Anatomy," all the absurdities, without the good sense, contained in the "Elementa Physiologiæ of Haller;" and in addition, more idle, extravagant, unintelligible theories, misnamed anatomical, than ever yet were collected into a single volume,

PRELIMINARY OBSERVATIONS.

1. Some beings are endowed, during a determinate period, with the wonderful faculty of resisting in a certain degree, the general laws of nature, which constantly tend to their destruction, and with which they maintain a sort of continual struggle. This faculty constitutes the essential characteristic of the life which these beings possess. Its source is to be found in the existence of the *organs* which enter into their composition; and the science to which belongs the examination of these organs or instruments of life, the art of mechanically separating them from each other, that of laying them bare to the view, and of isolating all their parts, in a word, the science of the organization, is named *Anatomy.*[*] All organized bodies are the subjects of this science.

2. As living beings are divided into two great sections, namely, Vegetables and Animals, so there are two kinds of anatomy, viz. *Vegetable Anatomy* or *Phytotomy*, and *Animal Anatomy* or *Zootomy.*

3. The peculiar object of the latter kind of anatomy is the knowledge of the animal organization, considered in a material point of view, or the aggregate of all the apparent qualities of the organs which enter into the composition of the body of animals. It discloses the number, situation, forms, proportions, connections, structure, texture, and intimate conformation of each of them; it assists in discovering and explaining the laws that regulate the functions which they are destined to perform. The knowledge of this science is obtained by inquiries and experiments made upon dead bodies, by means of dissection, and numerous other processes, such as desiccation, corrosion, injection, maceration, the construction of skeletons, &c.

4. Animal anatomy is divided into *Human Anatomy* or *Anthropotomy*,[†] and *Comparative Anatomy*, according as it treats of the organization of the human body, or of that of other animals.

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[*] Ανατέμνω, *disseco.* Some authors have proposed to substitute for the word *Anatomy*, those of *Morphology*, *Physiography*, *Organography*, and *Organology*, which, however, have by no means been generally adopted.

[†] Ανθρωπος, *homo*; Τομή, *dissectio.*

The study of the latter often throws much light on the former; but as it is with the anatomy of man that the physician and surgeon are more particularly concerned, it being the basis of all their acquirements with reference to the science which they are called to profess, we shall in the present work confine our attention solely to it. The numerous organs of which the human body consists, we shall consider principally with reference to the forms which they present, and the mutual relations which they possess; and this view of the subject is what constitutes *Descriptive Anatomy*, properly so called, which is itself capable of being divided into the *Particular Anatomy of Organs*, or *Morphology*, and the *Anatomy of Regions* or *Topographical Anatomy*, if we may use the expression; while that part of the science which treats of the structure and properties of the different tissues which are common to several organs, takes the name of *General Anatomy* or *Histology*. To the latter belongs the examination of the general characters of all the organs and humours.

OF THE ORGANIC ELEMENTS.

5. When the analysis of the organs is carried to the highest possible degree, in other words, when they are examined by the processes of chemistry, there are ultimately obtained the following elementary bodies: carbon, hydrogen, oxygen, azote, phtore, phosphorus, sulphur, iron, manganese, calcium, sodium, potassium, silicium, magnesium, and chlorin, forming so many *inorganic elements* or constituent principles, independent of climate or the sort of food of the individuals in the organization of which their presence has been detected. Now, before arriving at this term, it is discovered that these principles, which are derived from inorganic bodies, and which present no distinctive peculiarities, give rise, by their mutual combination, to what is called the *organic elements*, forming a kind of substances which may be extracted from the bodies of animals by very simple processes. These organic elements are: gelatin, albumen, fibrin, fat, mucus, and certain other substances less generally distributed, or only existing under particular circumstances, as urea, osmazome, picromel, picrocholine, the green matter of the bile, cholesterine, zoohematine or colouring principle of the blood which does not contain iron, water, sugar, resin, leucine, stearine, elaine, uric acid, caseum, lactic, hydro-cyanic, oxalic, benzoic, sebacic, margaric, purpuric, and rosacic acids, phosphate and carbonate of lime, &c.

6. *Gelatin* is a substance destitute of smell, taste, or colour, heavier than water, dissolving in that fluid when warm, and rendering it more or less viscid, forming what is called an *animal jelly*, which, on being left to itself, quickly turns sour, and passes into putrid decomposition. Acids favour the solution of gelatin. Chlorin, which was formerly called oxygenated muriatic acid, forms with its solution, a white pearly precipitate. The alkalies do no render it turbid; but alcohol, and especially tannin, pre-

cipitate it. The latter even forms with it a compound which is not liable to putrify. Hydrochlorate of iridium and of deutoxyde of mercury, nitrate of mercury, sulphate of platina, and persulphate of iron, also precipitate it, while most of the other metallic salts do not act upon it.

Gelatin does not occur naturally in any animal liquor, which seems to confirm M. Thenard's opinion that it does not exist ready formed in the economy, but is produced by the action of caloric.*

7. *Albumen*† is a very viscid, transparent fluid, nearly destitute of smell, and tasteless, frothing on being agitated in water, becoming concrete by the action of caloric, emitting a peculiar smell under the application of heat, and coagulating through the influence of alcohol. It unites with all the acids in the same manner as the salifiable bases, and more frequently forms ternary combinations with the metallic solutions. Lastly, it always contains sulphur and subcarbonate of soda, which gives it the property of colouring green the tincture of mallows and the syrup of violets.

This substance is found in almost all the animal fluids, the chyle, the synovial fluid, the serum of the blood, &c.

8. *Fibrin* or *Gluten*, is a whitish, elastic, solid, filamentous, soft substance, destitute of smell and taste, insoluble in water, alcohol or ether, soluble without being decomposed in vegetable acids diffused in water, and in weak alkalies. It enters very largely into the composition of the blood, and forms nearly the whole of the muscles. It is also met with in the chyle and in the humour exhaled from the internal surface of the serous membranes.

9. *Fat* or *oil* exists in almost every part of the body of animals, varying however in its physical properties, being sometimes fluid, sometimes solid, at one time white, at another coloured, but always unctuous to the touch, destitute of smell, of a mild taste, so as to be nearly insipid, insoluble in water, and lighter than that fluid. It melts under the action of caloric at a rather low temperature, frequently at 15° Reaum. for example, and takes flame at a high temperature, becoming at the same time decomposed. With alkalies it forms soap, and is converted into a mild principle, and into margaric and oleic acids.

M. Chevreul has shown that all the fats are composed of two immediate principles, *stearine* and *elaine.*

10. *Mucus* is a viscid, ropy, transparent fluid, without smell or taste, difficultly soluble in water, insoluble in alcohol, frothing in the former of these fluids by agitation in the air, not forming a jelly, and incapable of coagulating, but easily dried by heat. It is precipitated by chlorin, alcohol, and acetate of lead, but is not so either by tannin or deutochloride of mercury. It occurs at the

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* It appears, however, that, latterly, Berzelius has met with it in the blood.

† The Latin word *albumen*, signifies the white of an egg, which is almost entirely composed of this principle.

surface of the mucous membranes, in the synovia, the urine, the hair, the nails, the seminal fluid, &c.

11. The organic elements variously combined with one another, and with certain of the elementary bodies properly so called, such as phosphorus, iron, &c. give rise to the *fluids* and *solids* constituting the general mass of the body, which continually act and react upon each other, and which exist in a state of essentially mutual dependence and connection.

The former of these elements, the study of which is named *Hygrology*[*] or *Zoochymy*,[†] constitute the greater part of the organs, their quantities varying, however, according to a multitude of circumstances. It is in fact very difficult to determine their relative bulk, but in general the proportion which they bear to the solids is as nine or six to one. Accordingly, a fresh carcase which weighs about 120 lbs. does not weigh more than eight when thoroughly dried; and even the bones have only a third of their weight of solid matter. All the fluids, moreover, are contained either in vessels, or in areolar and spongy tissues, or reservoirs; as is the case, for example, with the blood, the serous fluid of the cellular tissue, the bile, the seminal fluid, the chyle, the vitreous humour, &c.

12. The solids give form and consistence to the different parts of the body. Their particles are variously interwoven, on which account the name of *texture* is applied to their conformation. It is of them that the organs are really formed. Composed of the same elements as the fluids, they are the recipients of these latter, and either retain them or allow them to escape; but they are always so combined with them as nowhere to exist in an isolated state. Their study bears the name of *Stereology*.[‡]

13. Every organ, then, is a compound of heterogeneous parts, of solids and fluids, and has for its principal basis the former, disposed into an areolar or cellular tissue, which is soft, extensile, contractile, and permeable to fluids. The solids are condensed into membranes, hollowed into canals, and modified in a thousand ways with respect to figure and colour, consistence and texture, volume and complication, &c.

14. By the mechanical division of the solids, there are always ultimately obtained minute laminæ or filaments, which seem to be their elementary molecules, and whose aggregation and co-ordination produce all the kinds of tissues that are observed in the animal economy. The extreme term of this division, however, is yet unattained. The smallest perceptible fibres may be divided into others still smaller, and all researches into the nature of the original fibre are now with propriety abandoned, the means of investigation which man has received with life being inadequate to its detection.

15. All that can be learned with precision on this subject is

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[*] Υγϱος, *humidus*; λογος, *sermo*.

[†] Ζῶον, *animal*; χυμός, *humor*.

[‡] Στεϱεός, *solidus*; λογος, *sermo*.

that in the human body, the solids as well as fluids are formed of microscopic globules and an amorphous substance, which in the latter is fluid, in the former concrete, coagulable in the one kind, and coagulated in the other.

OF THE DIFFERENT KINDS OF TISSUES.

16. The elementary fibres or lamellæ variously combined or associated, form the containing parts of the body, those which especially determine the form, and impress motion: that is to say, tissues more or less compound, organs more or less complex, of which none is isolated, but which are all interlaced and mutually connected. They are as follows:

A. The *Cellular* or *Areolar Tissue*, *(Tela cellularis)* an assemblage of whitish, filamentary, extensile, tenacious, and retractile laminæ, which is met with in all parts of the body in general, surrounds all the organs, penetrates into their interstices, serving at the same time to unite or separate them: a sort of web which is everywhere extended, and forms the more or less soft, extensile, contractile, spongy, and permeable parenchyma of their substance.

B. The *Membranes*, *(Membranæ)* broad, thin, and soft organs, composed of fibres or laminæ variously aggregated, lining the different cavities of the body, surrounding many of the viscera, often serving to facilitate the motions, and containing in their structure many vessels of different orders, and frequently nerves.

C. The *Vessels*, *(Vasa)* which are branched canals, more or less elastic, formed by the superposition of different membranes, and distinguished according to their uses and general disposition into *Arteries*, *Veins*, *and Lymphatic Vessels.*

The *Arteries*, *(Arteriæ)* after leaving the heart, proceed in a radiating manner from the centre to the circumference, and are distributed through all parts of the body, whither they carry the blood which has undergone the changes operated upon it by respiration.*

The *Veins*, *(Venæ)* in general, arise from the extreme ramifications of the arteries, unite into trunks of greater or less size, and proceeding from the circumference to the centre, pour into the heart the blood which they have collected from the whole system. Besides being much more numerous than the arteries, the veins are more capacious. Their walls are semitransparent and much thinner than those of the arteries, which are opaque, thick, and of a yellowish colour. Their internal cavity is interrupted at intervals by valves which are not met with in the arteries, and which are intended to support the blood, so as to obviate the effect of gravity upon it.

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* The pulmonary artery conveys to the lungs the dark or venous blood which has already circulated in the body. K.

The *Lymphatic*, or *absorbent vessels*, (*Venæ Lymphaticæ, Ductus Lymphatici,*) are also thin, transparent, and furnished internally with valvules; but, in place of blood, they contain a peculiar fluid named *lymph*, which they empty into the veins.*

We may also consider as vessels the *Excretory Ducts*, (*Ductus Excretorii,*) which arise from the glandular organs, and transmit externally, or into particular reservoirs, the fluid secreted by them.

D. The *Bones*, (*Ossa,*) which are the hardest, most compact and solid parts of the body. They furnish a basis and support for the other organs, and are composed of a cartilaginous and cellular organised parenchyma, incrusted with earthy salts.

The aggregate of all the bones in the body bears the name of *Skeleton*.

E. The *Cartilages*, (*Cartilagines,*) whose substance, which is of a milky-white and opaline colour, is less compact, less heavy, less hard, and more elastic than that of the bones, and is capable of being reduced to gelatin by boiling. They are flexible and elastic, and sometimes serve to prolong the bones, as is the case with those that are observed between the ribs and sternum; or they cover their articular extremities, as in all the moveable joints. In other cases, they enter into the formation of organs, as in the larynx, the nose, &c. The direction of their fibres is not easily perceived, because they are so close that at first sight they appear to form a homogeneous whole.

F. The *Fibro-Cartilages*, or *Membraniform Cartilages*, which are intermediate between the cartilages, properly so called, and the ligaments, and appear to be nothing but the latter incrusted with gelatin. They possess great flexibility, are highly elastic, very thin, and compose certain organs, such as the external ear, and the trachea; or enter into the constitution of joints, as those which occur in the articulations of the clavicle and jaw, the knee joint, &c. Cartilages of this kind also exist wherever there is much friction of a tendon upon the periosteum of a bone, as is observed at the lower extremity of the tibia, fibula, &c.

G. The *Ligaments*, (*Ligamenta,*) whose nature is evidently fibrous, and which are situated around the joints. They vary much in their form and general appearance, being sometimes expanded into membranes, and sometimes constituting compact, rounded, whitish cords of great strength, attached to the bones by their two extremities.

H. The *Muscles*, (*Musculi,*) which are organs of a red or reddish colour, possessed of great contractility, and composed of a fibrous tissue collected into fasciculi of various sizes, and kept together by cellular tissue, in which are seen vessels and nerves; and, what is peculiarly characteristic of them, linear series of microscopic globules.

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* A great division of these vessels is destined to carry the chyle from the intestinal canal, conveying it into the general mass of blood. These are called lacteals. K.

They constitute what is named the *flesh* of animals.

I. The *Tendons*, *(Tendines,)* white, glistening, fibrous cords, varying as to length and thickness, rounded or flat, very frequently terminating the muscles, and fixing them to the bones by one of their extremities only.

J. The *Aponeuroses*, *(Aponeuroses,)* which are fibrous membranes of a pearly white colour, iridescent, glistening, and sattiny, more or less broad and strong, of a dense, compact, elastic tissue, possessed of little extensibility.

They envelope the muscles, or furnish a point of attachment to their fleshy fibres.

K. The *Adipose Tissue*, an aggregation of very small and even microscopic vesicles, attached to each other by laminar cellular tissue, and forming a reservoir for the fat.

L. The *Elastic Tissue*, which forms organs of a peculiar yellowish tint, possessed of extreme elasticity, and of an albuminous and fibrinous nature, and is always in a state of antagonism to the action of gravity and muscular contraction, as in the arteries, the vertebral column, &c.

M. The *Nerves*, *(Nervi,)* soft whitish cords, of variable form, which divide into a great number of branches, which convey feeling and motion to all parts of the body, and which are formed of small filaments placed beside each other, and connected by cellular tissue and vessels, and of microscopic globules differently arranged from those which compose the muscles.

N. The *Glands*, *(Glandulæ,)* organs varying much in respect to form, size, colour, consistence and structure, but all destined to separate from the mass of the blood a fluid peculiar to each of them individually, and which is immediately rejected by means of ramified excretory ducts, or retained for some time in isolated reservoirs.*

O. The *Follicles*, or *Crypts*, *(Folliculi,)* membranous, vascular vesicles, of a rounded or lenticular form, in which is secreted a peculiar fluid, which is expanded over the surface of the part, and lubricates it. They are observed abundantly in the substance of the skin, in the mucous membrane, &c.

P. The *Lymphatic Ganglions*, *(Conglobate Glands* of the old authors,) small bodies varying in size and form, of a reddish or grey colour, whose intimate texture has not yet been determined, of a firmer consistence than any other soft organ, receiving on the one hand some lymphatic vessels, and on the other transmitting some which proceed to join their common trunk.

Q. Lastly, The *Viscera*, *(Viscera,)* which are organs of a very complicated structure, formed of most of the tissues which we have enumerated, and situated entirely or in part in the cavities of the trunk, where they are subservient to the most important functions of life.[*]

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* Some bodies termed glands have no excretory ducts; as the thyroid, thymus, supra-renal, glands; the spleen, &c. K.

To these different kinds of organic tissues we might still add the *Erectile*, or *Cavernous Tissue*, and the *Horny Tissue*, as several anatomists of the first order have recently done.[†]

DIVISIONS OF ANATOMY.

The study of anatomy is pretty generally divided, according to the mutual resemblance of the organs, into several distinct branches, which have corresponding denominations. Thus the department which treats of the hard parts is called *Sceletology*, while the word *Sarcology* is employed to designate that which considers the soft parts of the body.

Sceletology[‡] itself is divided into *Osteology*,[§] which refers to the bones only, and *Syndesmology*,[||] which treats of the ligaments.

Sarcology,[¶] in like manner, is divided into *Myology*, *Neurology*, *Angiology*, *Adenology*, *Splanchnology*, and *Dermology*,[**] according as its subjects are the *muscles*, *nerves*, *vessels*, *glands*, *viscera*, or *integuments*.

In this treatise we shall adopt another mode of division, already promulged in various modern works; we shall examine the organs with reference to their physiological relations, according as they serve to connect us with surrounding bodies, or contribute to the nutrition of the individual, or are intended to be employed for the propagation of the species.

To the first class belong the organs of locomotion, speech, and sense; to the second, those of digestion, respiration, circulation and absorption, and of the secretions; while the third contains those of generation.

One of the great advantages of this method is that it intimately connects anatomy with physiology.

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[*] Some authors have also distinguished the *organs*, which according to them, differ from the viscera only in being situated externally. But this denomination has very evidently a much too general signification. In the living being, in fact every part that manifests the existence of life by its acts, or supports it by its exercise, is an organ.

[†] Anatomists and Surgeons make frequent use of the term fascia; we shall afterwards explain the meaning of this term. K.

[‡] Σκελετὸς, *cadaver exsiccatum*; λογος *sermo*.

[§] 'Οστεον, *os*; λογος, *sermo*.

[||] Σῦνδεσμος, *ligamentum*; λόγος, *sermo*.

[¶] Σαρξ, *caro*; λόγος, *sermo*.

[**] Μῦς *musculus*; Νεῦρον, *nervus*; 'Αγγειον, *vas*; 'Αδὴν, *glandula*; Σπλὰγχνος, *viscus*; Δερμα, *cutis*; λόγος, *sermo*,

CLASS FIRST.

ARTICLE FIRST.

ORGANS OF LOCOMOTION.

18. The essential organ of motion is the fleshy or muscular fibre, which, by contracting under the influence of the will, determines partial changes of position in the body of animals, or even causes them to remove entirely from the place which they originally occupied. But in order that motions of this kind may be performed with the requisite precision, it is necessary that the muscles should be attached to hard parts, whether within or without the body, which serve as levers, and afford fulcra to each other. Hence the very natural division of the locomotory apparatus into two kinds, the one consisting of the passive organs of locomotion, the other of its active organs. The bones and their appendages belong to the former, the muscles and the parts connected with them to the latter.*

DESCRIPTION OF THE PASSIVE ORGANS OF LOCOMOTION.

CHAPTER FIRST.

OF THE BONES.

§ *Preliminary Remarks.*

19. The bones are the hardest, driest, most solid, and most compact organs of the body of animals. Having little flexibility, and being incapable of extension, they are easily broken. In general, their colour is an opaque white, reddish externally, and of a more or less deep red internally, when they are fresh. In man, and the animals of the higher orders, they are surrounded by the muscles and teguments, whether they form cavities for the nervous and vascular centres, or constitute the framework of the limbs. They are all internal. They are immediately invested on the outside

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* There are *internal*, *involuntary*, *organic motions*, by means of which each of the functions appears to be performed. These have no connection with the motions referred to in the present article.

with a fibrous membrane, called the *periosteum*, and are moistened through their whole substance by an oily fluid.

20. The bones receive their nourishment from the blood, which is carried to them by the arteries, and whose residuum is carried off by the veins which accompany the latter. No lymphatic vessels have as yet been discovered in them; but M. Dumeril has seen nerves which penetrated into their tissue along with the arteries. That they contain much cellular tissue, is demonstrated by the phenomena of the formation of callus, and by long maceration in acidulous water.

21. On examining these organs with reference to their intimate constitution, it is observed that they are composed of two principal elements, viz. an organized parenchyma, formed of gelatin, and an inert salino-terreous substance, which fills up the areolæ of the parenchyma, and which exists in the midst of these living parts only for the purpose of giving them a solidity which is absolutely necessary for the performance of the functions that have been allotted to them.

22. The existence of the parenchyma of bones is demonstrated, 1st, By immersing them in a mineral acid diluted with water, which removes the saline matter, and leaves untouched a cartilaginous body retaining the form of the bone; 2dly, By boiling in Papin's digester, which produces an opposite effect, the parenchyma being dissolved and forming a jelly, and the bone, reduced as it were to its skeleton, retaining its form, but becoming friable; which also takes place when the gelatine of pounded bones is extracted by the process of MM. Cadet de Vaux and d' Arcet; 3dly, By the appearances exhibited in certain diseases, in which the bones become soft and almost cartilaginous, as in *rachitis* in particular.

23. If a bone be burnt, its gelatinous part is destroyed, and there is obtained another element, which is white, friable, and brittle, unless the heat employed has been so great as to reduce it to a state of imperfect vitrification. If it be exposed to the action of the air for a long time, it falls into powder for the same reason. If potash is poured into the acid in which a bone had been partly dissolved, the earthy matter is precipitated. Lastly, Some diseases, cancer for instance, render the bones very fragile, on account of the greater relative quantity of this matter which they induce in them.

24. The gelatin and fat constitute more than half the weight of the bones. The rest of these organs is composed of inorganic matter, which is formed of phosphates of lime, magnesia, iron, and manganese, carbonate of lime, and silica and alumina, as has been demonstrated by M. Vauquelin. Sulphate and fluate of lime, and phosphate of ammonia and soda, have also been supposed to be detected in them. Phosphate of lime, however, undoubtedly forms the predominant ingredient in the constitution of the bones.

25. By the combination of the various elements of which we have been speaking, there are formed fibres, which are of the same nature in all the bones, but which present themselves under two different aspects, which gives occasion to the distinction in these

organs of the *cellular*, the *areolar* or *spongy tissue*, and the *compact* tissue.

The former of these tissues results from the interlacing of a multitude of laminæ running in all directions, and leaving between them small vacuities or cellules of variable extent, generally very irregular in their form, and communicating with one another, as is demonstrated by the circumstance, that mercury may be made to pass through them. This tissue almost always occupies the centre of the bones. The inferior turbinated bones of the nose, according to most anatomists, form the only exception. We shall presently see how far this opinion is correct.

The *reticular tissue* of authors is merely a variety of the cellular tissue, in which the cellules are larger, and the laminæ and fibres by which they are bounded much thinner and more delicate.

The *compact tissue* is formed by fibres placed so close as to leave no intervals, without their being held together however by small pegs, as Gagliardi imagined. This tissue commonly exists at the surface of the bones, and lines the various apertures that may occur in them. Although by the naked eye no interstices are perceptible between the fibres or lamellæ of which they are composed, the microscope discovers small medullary and vascular canals in the substance.

26. The bones vary much in size, some of them being a fourth, a fifth, or a sixth of the length of the body, while others of them are not more than a few lines in diameter.

27. Their form is always symmetrical, some being *median* and *single*, others *lateral* and in *pairs*.

In the former, the one lateral half is a counterpart of the other.

In the latter, the bone of one side of the body corresponds exactly to that of the opposite side.

28. With respect to figure, the bones are distinguished into *long*, *flat*, and *short*, according as the length or the breadth predominate in their dimensions, or are equal to the thickness. This division, which is founded on the relative proportions of their three geometrical dimensions, is however subject to some exceptions ; and there are in fact bones, which in one respect may be considered as long bones, while in another they ought to be arranged among the flat : of which kind are the ribs, and the lower jaw.

29. The *Long Bones (ossa longa*, sive *cylindrica)* occur in the limbs. Those nearest the trunk are longest and less numerous. Their extremities are enlarged, and their middle part, which is named their *body* or *diaphysis*, is contracted, and most commonly triangular and twisted. Their centre is perforated by a cylindrical cavity, named the *medullary canal*, which renders the bones stronger without increasing the quantity of matter which enters into their composition, and is larger in old than in young individuals. This cavity is divided into numerous cells by the threads of the reticular tissue of which we have spoken above, and which extend in different directions from one wall to the other.

30. The body of these bones, which is whiter than the rest of their extent, is everywhere composed of a very thick compact tissue, of which a very thin layer only covers the spongy substance of their extremities, and whose fibres have a longitudinal disposition, although they are inclined over each other in all directions, forming numerous connections by means of transverse and oblique fibres, and constituting superimposed plates.

31. The *Flat* or *Broad bones (ossa lata* sive *plana)* are for the most part destined to protect important viscera, and by uniting together form the walls of certain cavities, such as those of the cranium, pelvis, &c. They are almost all bent upon themselves, and their margin, which is generally a little thickened, forms articulations, or affords insertion to muscles.

They are formed of cellular tissue contained between two thin tables of compact tissue, whose fibres are frequently radiated. In the bones of the skull in particular, this cellular tissue has received the name of *Diplöe* or *Meditullium.*

32. The *Short Bones (ossa crassa)* are always of small dimensions, and generally globular, tetrahedral, cuboidal, cuneiform, or polyhedral. They occur associated in great numbers in the regions which they occupy, as in the tarsus, carpus, and vertebral column. Their surface, which is always uneven, presents many cavities and eminences; and, like the flat bones, they have no medullary canal. In general also, their articulating surfaces are broad.

These bones are composed of cellular tissue, surrounded by a thin compact lamina, with fibres crossing each other in all directions. Their whiteness is never so great as that of the flat bones, and of the diaphysis of the long ones.

33. The surface of the bones is often raised into eminences, to which the general name of *Apophyse* or *Process*,† is given. During the earlier periods of life, however, these eminences are for the most part called *Epiphyses*,‡ because they are then pretty frequently separated from the rest of the bone by a cartilaginous substance, which is not the case at a more advanced stage, when all the apophyses are perfectly continuous with the substance of the bones, and form part of the same body.

The following table contains an enumeration of the different kinds of apophyses, together with their peculiar characters.

I.—APOPHYSES FORMING ARTICULATIONS.

* *Those which belong to the moveable articulations.*
Heads, which are nearly hemispherical.
Condyles, which are broader in one direction than in the other.
* * *Those belonging to articulations that do not admit of motion.*
Dentations or *Teeth, Roots*, &c.

II.—APOPHYSES AFFORDING ATTACHMENT TO FIBROUS ORGANS.

and which are named,
* *according to their general forms.*

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† Αποφυομαι, *nascor de, exorior.*

‡ Επιφυομαι, *adnascor.*

Impressions, unequal eminences, not much raised, extended in breadth, and formed of a great number of small tubercles placed very close together, and separated by slight depressions.
Lines, unequal eminences, not very prominent, but extended in length.
Ridges, eminences resembling lines, but smooth, and more distinct.
Bumps, when they are rounded, broad, and smooth.
Protuberances and *Tuberosities,* when rounded and rough,
* * *according to the bodies to which they are compared.*
Spinous Apophyses, in the form of a spine or thorn.
Styloid, in the form of a conical point.
Coracoid, like the beak of a crow.
Odontoid, or *tooth-like.*
Mastoid, or *mamillar,* like a nipple,
* * * *according to their uses.*
Trochanters, or those which are subservient to turning.
Orbitary, belonging to the orbit, &c.
* * * * *according to their direction and relative situation.*
Ascending, vertical, transverse, superior, &c.

III.—Apophyses intended for the Reflection of Certain Tendons which Deviate from their Original Direction.

IV.—Apophyses which Correspond to Cavities Existing on the surface of Organs.

34. In the apophyses, the direction of the fibres of the compact tissue is not the same as in the rest of the bone. They are longitudinal in those which are elongated, and run in all directions in such as are large and thick; but they are never radiated, excepting in the bumps of the broad bones of the cranium.

35. The bones also present various kinds of cavities at their surface, which are usually characterized as follows:—

I.—Articular Cavities, which are called,

Cotyloid, when they are hemispherical.
Glenoid, when broad and shallow.
Trochliform, when scooped in the form of pulleys.
Faces, when nearly plane.
Alveolæ, when of a conical form.

II.—Cavities which do not belong to Articulation.

* *such are intended for the reception of parts.*
Fossæ, when the entrance is wider than the bottom.
Sinuses, when it is narrower.
* * *Cavities for the insertion of parts.*
Impressions, when they are wide, unequal, and shallow.
Grooves, when extended in length.
* * * *Cavities for the passage of tendons.*
* * * * *Cavities formed by the impression of parts.*
Grooves, when they correspond to arteries.
Gutters, or *Channels,* when they correspond to veins.
* * * * * *Cavities subservient to transmission.*
Notches, when superficial, and formed in the edges of bones.
Foramina or *Holes,* when they pass through a thin bone.
Canals, or *conduits,* when their passage is of great extent, or when formed by the superposition of several bones.
2 * * * * * * *Cavities which transmit vessels for the nourishment of bones.*
1 Clefts, or fissures, if they are longitudinal or very narrow.

Those giving passage to the vessels of the medullary organ of long bones.
Those intended for the vessels of the cellular tissue of the extremities of long bones, and of the short bones.
Those for the vessels of the compact tissue.

36. The cavities which transmit the vessels to the medullary organ are very distinct, and are always met with on the body of the long bones, where they pass obliquely between the fibres of the compact tissue. Those which belong to the cellular tissue are always associated in great quantities, in which respect they differ from the preceding, which are always single, at least in man. They are equally distinct; but those which are observed in the compact tissue are mere pores, rendered visible principally by the blood which issues from them in the fresh state of the bones.

37. Like the apophyses or eminences of which we have spoken above, the cavities in question are sometimes formed by a single bone, which is the more ordinary case, sometimes by the concurrence of several osseous pieces; but they are never, as is too commonly imagined, the result of pressure.

38. The bones in their fresh state are covered over the greater part of their extent, and excepting only the surfaces by means of which they are articulated to each other, by a fibrous, dense, and strong membrane, shaggy on its outer surface, containing a great number of vessels, feebly adhering to the bone in early age, and affording a point of attachment to all the fibrous organs of the system, excepting the tunica albuginea, the sclerotica, the pericardium, and the fibrous capsules of the liver, spleen, and other viscera. Various names are applied to this membrane, according to the parts where it is observed. On the skull, it is called the *pericranium*;[*] on the cartilages, the *perichondrium*;[†] on the bones in general, the *periosteum*.[‡]

39. The medullary canal of the long bones is filled by a thin, pellucid, vascular membrane, folded upon itself a great many times, divided into cellules or vesicles, by multiplied prolongations which extend from one of its sides to the other, and filled with an oily inflammable fluid, of a whitish or yellowish colour, which is only so during life, and after death presents itself under the form of small shining grains. This substance has received the name of *marrow, (medulla.)* It is formed by exhalation.

40. The cellular tissue of the extremities of the long bones, the diploe of the flat bones, and the interior of the short bones, are also lined by a membrane, which appears to be nothing else than an expansion of vessels anastomosing ad infinitum with one another. This vascular network also furnishes a fat substance, resembling the preceding, but having less consistence, and of a reddish tint.

41. The medullary fluid does not occur solely in the large cavi-

[*] Περι, *circa*; Κρανιον, *calvaria.*

[†] Περι, *circa*; Χονδρος, *cartilago.*

[‡] Περι, *circa*; Οστεον, *os.*

ty of the long bones and in the spongy tissue, but also fills up the interstices of the laminæ of the compact tissue, and the porosities with which they seem perforated. The sinuses and air-cells of the bones of the skull, however, do not contain any.

OF THE SKELETON IN GENERAL.

42. The hard parts of the body taken collectively, bear the name of *Skeleton*, as we have already said. Almost all animals have a skeleton, but it does not exhibit the same arrangement in all. Of whatever nature it be, its object is to sustain the other organs: it forms the steady foundation on which is erected the whole edifice of the living machine, constituting a solid frame-work, the various parts of which, connected by flexible ligaments, are, at the same time, capable of moving on each other, and of resisting the effects of a foreign motion. It is on it that the general form of the body depends, as well as that of its various parts; and it is by it that their proportions, figure, solidity, and principal divisions are determined.

43. When the bones are connected by their own ligaments in the cabinet of the anatomist, the skeleton is called a *natural* one, when, on the other hand, they are joined together by connections of a different kind, such as wires or plates of silver, iron, &c. it is denominated an *artificial* skeleton. Skeletons are also distinguished into those of fetuses, children, adults, women, men, &c.

44. The primary divisions of the skeleton in man are into *Trunk* and *Limbs*.

The trunk consists of a middle part and two extremities.

The middle part is formed by the vertebral column and the chest united.

The *Vertebral Column*, which is composed of twenty-four bones called *vertebræ*, is divided into three regions: the *cervical*, corresponding to the neck, which has seven vertebræ; the *dorsal*, which has twelve; and the *lumbar*, which has five.

The *Chest* or *Thorax*, is formed anteriorly and in the middle by the *Sternum*, and on each side by the twelve *Ribs*, which are distinguished into seven *true* or *vertebro-sternal* ribs, and five *false* or *asternal* ribs, the former being placed above the latter.

The upper extremity of the trunk is the *Head*, which comprehends the *Cranium* or *Skull*, and the *Face*.

The *Skull* contains the following bones: the *Sphenoid*, the *turbinated bones of the Sphenoid* (or of Bertin), the *Ethmoid*, the *Frontal*, the *Occipital*, the two *Temporal*, the two *Parietal*, the *Ossa Wormii*, the *Mallei*, the *Incudes*, the *Lenticular Bones*, and the *Stapedes*.

The *Face*, which is divided into the *Upper Jaw* and the *Lower Jaw*, is composed of the *Upper Maxillary* bones, the *Palatine*, *Malar*, *Nasal*, and *Lachrymal* bones, the *Lower Turbinated* bones, and the *Vomer*, which form the upper jaw, together with the *Inferior Maxillary Bone*, which of itself forms the under jaw. To the face must also be referred the thirty-two *Teeth* which are found in the adult, and the *Hyoid Bone*,* which is situated on the fore and upper part of the neck.

The lower extremity of the trunk is the *Pelvis*, which is formed of the *Sacrum*, the *Coccyx*, and the *Haunch Bones* or *Ossa Innominata*.

The upper or thoracic limbs consist each of four parts:

1st, The *Shoulder*, which is formed of the *Clavicle* and *Scapula;*

2d, The *Arm*, consisting of the *Humerus;*

3d, The *Fore-arm*, composed of the *Radius* and *Cubitus;*

4th, The *Hand*, which is itself divided into the *Carpus*, *Metacarpus*, and *Fingers*.

The *Carpus* consists of eight bones arranged in two series, and which, commencing from the radial side, are named as follows: In the first row, the *Scaphoid*, *Semilunar*, *Pyramidal*, and *Pisiform* Bones; in the second, the *Trapezium*, *Trapezoides*, *os magnum* and *os unciforme*.

The *Metacarpus* results from the aggregation of five bones, which are distinguished into *first*, *second*, &c. counting from the radial side.

Each of the fingers, excepting the thumb, which has only two, consists of three bones, named *Phalanges*.

The lower or abdominal limbs are divided into three parts, the *Thigh*, the *Leg*, and the *Foot*.

The thigh consists of a single bone, the *Femur*.

The leg is composed of three, the *Patella* or *Rotula*, the *Tibia*, and the *Fibula*.

The foot, like the hand, is divided into three parts, as follows:

1st, The *Tarsus*, consisting of seven bones arranged in two rows of which the first is formed by the *Astragalus* and *Calcaneum*, and the second by the *Scaphoid Bone*, the three *Cuneiform Bones* and the *os cuboides*.

2d, The *Metatarsus*, consisting of five bones, which are distinguished into *first*, *second*, &c. counting from within outwards, and not, as in the hands, from the outside.

3d, The *Toes*, which consist each of three *Phalanges*, excepting the first or great toe, which has only two.

The skeleton also presents several anomalous bones, whose existence is not constant. These are the *Sesamoid Bones*, which are developed in the substance of certain tendons.

45. We have still to remark here that the number of the bones is what we have above represented it only in adults, and that to determine it with strict accuracy, it becomes necessary to take into

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* The anatomist might, with as much propriety, say, "the bone of the finger," as the hyoid bone. In the assemblage of bones termed *hyoid*, there are five distinct bones. K.

consideration the age, and the peculiarities of the individual. In early childhood, a bone may consist of several pieces, which afterwards become united into one.

46. Man walks upright, supporting his body on the heel and the whole sole of the foot. The external conformation of his body is symmetrical: his head occupies the upper part; the breast and belly are placed before; and the back is situated behind. The line of direction of the human body is vertical, forming an angle of 90 degrees with the ground on which it rests; and this line, which is supposed to pass through the summit of the head, to terminate between the feet, serves as a basis for the application of regional names to the different organs, according as they are, with reference to it, *anterior*, *posterior*, *lateral*, *superior*, &c. It is named the *vertical median line*, and divides the body into two similar halves.

III.—OF THE TRUNK.

1*st*, OF THE VERTEBRAL COLUMN.

47. The *Vertebral Column*, which is also named the *Spinal Column* or *Spine*, is a sort of bony flexuous shaft, placed at the posterior and central part of the trunk, and extending from the head to the sacrum. Although capable of bending in all directions, it is yet very solid, and is excavated by a canal, bearing the name of *Vertebral*, which gives it lightness without diminishing its strength, and which runs along its whole extent. It is rounded before, elevated into an interrupted ridge behind, and perforated on the sides with a great number of holes.

This part of the trunk is composed of twenty-four short and very angular bones, placed one above the other, and named *Vertebræ.*

A.—OF THE VERTEBRÆ IN GENERAL.

48. Form. In every *Vertebra*, which is symmetrical, and formed on each side of several very angular portions, there are distinguished a body, seven processes, four notches, and a hole.

The *Body (Corpus)* occupies the middle and anterior part. It is cylindrical or oval, thick and broad. Above and below, it is adapted to certain cartilages, which are placed between the vertebræ. Transversely convex before, it forms part of the vertebral hole behind, and in both these directions, but especially the latter, presents several distinct vascular apertures.

The seven processes of each vertebra are:—1*st*, The *Spinous Apophysis*, or *Process*, *(Processus Spinosus,)* situated behind and on the median line, most commonly terminating in a point, and bifurcating at its base, to unite, by means of two osseous planes, named *Vertebral Laminæ,* with the transverse processes.

2d, The two *Transverse Apophyses* or *Processes, (Processus Transversi,)* which are directed outwards on either side, and give attachment to muscles.

3d, The four *Articular* or *Oblique Processes, (Processus Obliqui,)* of which two are superior, and two inferior. They are covered with cartilage, and serve to connect the vertebræ with each other.

These different processes are united in such a manner as to form a sort of ring of the upper and lateral parts of the vertebræ. This ring is joined to the body by a kind of pedicle, in which are scooped out, above and below, the *Notches,* which are deeper in the latter than in the former direction, and which by their union form the holes of conjunction, or intervertebral foramena.

The *Hole* or *foramen* of the vertebræ, which is oval or triangular, and concurs to form the canal, is placed between the bodies and the processes.

The vertebræ are all articulated with one another.

49. *Structure* and *Development.* While the body of the vertebræ is cellular, their processes are almost entirely formed of compact tissue, being spongy only in the middle and in the places where they are enlarged. Sometimes, as Bertin has remarked, the spongy substance of the body of the vertebræ is very soft, and is even found substituted by three or four large cavities, separated by partitions, and ending in the vascular apertures of the posterior surface of the body.

The development of these bones generally takes place by three points, of which one belongs to the body, and the other two to the lateral and posterior parts. In newly-born infants, the spinous process is not yet formed. Sometimes it has a point of development of its own. Even at a pretty advanced age, the summit of the other processes is cartilaginous; and there are developed in its interior accessory points, or epiphyses, as well as at the upper and under surfaces of the body.

In this manner, each vertebra, properly speaking, commences its development by six or eight points, forming so many pieces, which are perfectly distinct at the period of birth, and which I have even met with in the bodies of individuals eighteen or twenty years of age.

50. *Divisions.* The vertebræ, as we have already said, occupy three regions, the neck, the back, and the loins, on which account they are distinguished into *cervical*, *dorsal*, and *lumbar*. In each of these classes they present peculiar characters, and they are commonly designated by their numerical name, counting from above, there being seven cervical, twelve dorsal, and five lumbar.

51. It is right, however, to observe, that each vertebra has a pretty close resemblance to the one preceding, and the one following it, both in form and size. The general character of the verte-

bræ of each region is also more decided in the middle part of that region than at its extremities, where they pass into those of the next region. In this manner, the last cervical vertebra forms a transition to the first dorsal, and the last dorsal has the greatest resemblance to the first lumbar.

B.—CHARACTERS OF THE DIFFERENT ORDERS OF VERTEBRÆ.

52. *Characters of the Cervical Vertebræ, (Vertebræ Colli.)* The vertebræ of the neck are smaller than the others. They have their *body* transversely elongated, a little thicker before than behind, which is also the case with the sides compared with the middle. It is concave above, and surmounted latterly by two small projecting laminæ; convex below, and presenting two superficial notches on the sides, which correspond to the laminæ of the upper surface. Another peculiar character which the body of these vertebræ possesses, is that its upper surface is broader than the under, in which respect they differ from the other vertebræ. The body is also lower than in the dorsal and lumber vertebræ. The *spinous process* is bifurcated, horizontal and short. There is a hole for the passage of the vertebral artery at the base of the *transverse processes*, which are short, bifurcate at the summit, and present a channel above, the edges of which give attachment to the intertransversal muscles. On account of the hole which passes across their base, these processes seem as if they had two roots, one of which arises from the body itself. The *lower articular processes* are of an oval form, somewhat concave, and are directed forwards and downwards; the upper are also oval, but present opposite characters. The *Laminæ* of the cervical vertebræ are longer and narrower than those of the others, and concur to render the *hole* proportionally larger, and of a triangular form, with the angles rounded. Its upper circumference is formed by a sharp edge, and is smaller than the lower, which seems to embrace the vertebra situated beneath. The *notches* are anterior to the articular processes.

53. *Characters of the Dorsal Vertebræ, (Vertebræ Dorsi,)* The dorsal vertebræ diminish in size from the last to the fourth or fifth, and then increase to the first, so that the fourth and fifth are always smaller than the rest. Their *body* has a greater diameter from before backwards than latterally, is thicker behind than before, flattened above and below, with its upper surface narrower than the under, and is very convex at its middle and fore part. At its sides it generally presents two demi-facettes, covered with cartilage, of which the upper is larger than the under, and which are articulated with the heads of the ribs. In the first nine dorsal vertebræ, the upper and under surfaces of the body are heart-shaped; but in the rest they are rounded. The *spinous processes* are long, of the form of a triangular prism, tubercular at the summit, inclined downwards, and imbricated. The *trans-*

verse apophyses, which are very long and large, are directed a little backwards. Excepting in the two last, their summit presents a rough tubercle, surmounted by a concave and cartilaginous facette, which is articulated to the tuberosity of the ribs. This facet is placed sometimes above, sometimes below, according to the vertebræ; but in the upper vertebræ, it is generally directed downwards, and the reverse in the lower. The *superior articular apophyses* are directed backwards, the *inferior* forwards; and are situated vertically above one another. The *notches* are larger than in the cervical vertebræ, and placed before the articular apophyses. The *hole* is no longer triangular, but of an oval form from before backwards, and is also smaller than in the neck. Lastly, the *laminæ* are broader and thicker.

54. *Characters of the Lumbar vertebræ (vertebræ lumborum.)* The lumbar vertebræ are remarkable for their great size. Their *body* is broader than high, more extended in the transverse than in any other direction, flat above and below, without lateral facets, concave from above downwards on its fore part, or rather bordered by two ridges, one above, the other below. The *spinous apophysis* is very broad, horizontal, transversely flattened, and quadrilateral. The *transverse apophyses* are very large and elongated; the *upper* are separated, concave, oval, and turned inwards; the *lower* close, convex, oval, and directed outwards. The *notches* are very large, especially below; the *laminæ* thick and broad, but shorter than in the other regions; the *hole* wider than in the back, and of a triangular form.

55. *Development of the Lumbar Vertebræ.* The transverse apophyses of these vertebræ are pretty frequently substituted by an elongated and pointed epiphysis, which occasionally remains for a long time moveable upon the body of the bone, and this bears more or less resemblance to a small rib. The upper articular apophyses are all in like manner terminated by a lenticular epiphysis in children.

PARTICULAR CHARACTERS OF CERTAIN VERTEBRÆ IN EACH REGION.

A. In the cervical region, the following vertebræ are distinguished by peculiarities of form:

56. The *Atlas*, or *First Vertebra, (Atlas,)* which has no resemblance to any other vertebra. In fact, it has neither body nor spinous apophysis, and merely presents the form of a ring, which is more or less thickened at the sides, and is formed anteriorly by a small compressed arch, which does not occupy more than a fifth part of the circumference. It is convex and tubercular arteriorly, concave in the opposite direction, where an articular oval facet is observed, which connects it with the tooth-like apophysis of the second vertebra. This arch is thin above and below, and gives insertion to ligaments. Posteriorly, the ring is completed by a

larger bony arch, which also gives attachment to ligaments above and below, and which is tubercular behind for the insertion of the posterior small recti muscles of the head. This arch is rounded and thick behind, but anteriorly, where it is confounded with the rest of the vertebra, it is depressed and marked above with a groove for the vertebral artery and suboccipital nerve, and below for the second cervical nerve. The atlas has moreover a large *vertebral hole*, divided by a ligament into two portions; of which the posterior alone contributes to the formation of the canal. Two irregular tubercles, on the inside of the upper articular apophyses, give attachments to this ligament. The *notches* are here situated behind the *articular apophyses*, which are nearly horizontal and very broad. The *upper* is concave, oval, and inclined inwards, and is articulated with the occipital bone; the lower is nearly plain, and also inclined inwards, and is connected with the axis. Lastly, the *transverse apophyses* are very long, terminate in a more or less obtuse point, and seem to rise by a double root, of which the anterior branch is more slender, the posterior longer and larger. The hole which perforates their base, is larger than in the other cervical vertebræ.

57. The atlas, which in the adult is almost entirely formed of compact tissue, and is articulated with the occipital bone and the axis, is sometimes developed by five points of ossification, one for the anterior arch, two for the posterior, and one for each of its lateral parts. But more commonly this vertebra commences its development with three points only, one median or two lateral points for the anterior arch, and two for the lateral masses and the posterior arch.

58. The *Axis* or *Second Vertebra*, (*Axis, Epistropheus*,) has a nearly triangular form. The body is much higher than broad, and is marked anteriorly with a central ridge and two hollows for the long muscles of the neck. From its upper part arises a long, rounded, vertical apophysis, named the *odontoid** or *tooth-like* process, which is articulated before with the anterior arch of the atlas, and is marked behind with a small convex surface for sliding on the transverse ligament. By its summit, which ends in an acuminated head, it gives attachment to the odontoid ligaments, which are connected with the occipital condyles, and is itself supported by a sort of *neck*. The *spinous apophysis* is here very large, and is marked below with a broad and deep channel. The *upper notches* are placed much farther back than the *lower*. The *superior articular apophysis* is nearly horizontal, thrown a little outwards, and convex. It is much broader than the *inferior*, which is turned forwards and downwards. The *transverse apophysis* is very short, and is neither bifurcated nor channelled. It seems, as it were, to arise from the upper articular apophysis, and the hole by which its base is perforated has an oblique direction,

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* 'Οδοὺς, ὀδὸντος, *dens*.

in which respect it is very different from the other cervical vertebræ. The *laminæ* are very thick and strong. Lastly, the vertebral *hole* is heart-shaped.

In the fetus, the second vertebra has a point of ossification more than the others, for the tooth-like apophysis. That process sometimes forms by two distinct germs.

It is articulated with the first and third vertebræ, and moreover with the occipital bone but not directly.

59. The *prominent* or *seventh vertebra*, differs from the rest only in being larger, and in having its spinous apophysis more elongated, and commonly not bifurcated, as well as in the circumstance of its transverse apophyses being generally destitute of a hole at the base.

This vertebra has always a point of ossification more than the others, consisting of a small rib-like bone placed transversely before the pedicle, which connects the processes to the body, and which is not united with it or the body of the vertebra until the age of five or six years. Sometimes its outer extremity extends beyond the summit of the transverse apophysis a few lines, an inch or even more, so as to form a rudimentary rib, analogous to the cervical ribs of certain animals.*

B. In the dorsal region, there are distinguished:

60. *The First Dorsal Vertebra*, of which the *body* is more extended transversely than from before backwards, and on the sides presents a complete costal impression above, and a half cavity of the same nature below, which is connected with a similar half cavity in the second dorsal vertebra. The *spinous apophysis* is thick and long with a tubercular extremity, and is nearly horizontal in its direction. The *articular apophyses* are oblique.

61. The *Tenth Dorsal Vertebra*, which generally has an entire articular impression, on either side of the body at its upper part, for the tenth rib.

62. The *Eleventh Dorsal Vertebra*, which is very remarkable for its size, and whose *body*, which is almost round, approaches much in its general appearance to the lumbar vertebræ, and presents on each side, towards the pedicle of the transverse and articular apophyses, a single entire depression for the eleventh rib. The *spinous apophysis* is short, broad, and horizontal. The *transverse apophyses* have no articular surface at their extremity.

63. The *Twelfth Dorsal Vertebra*, which presents exactly the same characters as the eleventh, but whose *transverse apophyses* are longer, and the *lower articular processes* convex and turned outwards.

C. In the Lumbar Region, there is only distinguished the *fifth* vertebra, which has its body cut obliquely beneath, so as to be much thicker before than behind, and is articulated in this direction with the sacrum. Its *transverse apophysis* is short, but strong and rounded.

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* Beclard, Memoire sur l'Osteose, *Nouveau Journal de Medicine*, Janvier, 1819.

64. The following are the more peculiarly distinctive characters of the different vertebræ.

1st, *Cervical vertebræ.* Spinous apophysis bifurcate; base of the transverse apophyses perforated by a hole.

2d, *Dorsal vertebræ.* Articular facettes on the sides of the body, and on the summit of the transverse apophyses.

3d, *Lumbar vertebræ.* Spinous apophyses quadrilateral, compressed, horizontal, tubercular at the extremity; articular apophyses, concave above, convex below.

4th, *Atlas.* No spinous apophysis or body; an annular form.

5th, *Axis.* Body surmounted by a large rounded tooth-like apophysis.

6th, *Prominent vertebra.* Spinous apophysis very prominent.

7th, *First Dorsal vertebra.* An entire articular cavity above, a half cavity only below, on the sides of the body.

8th, *Tenth Dorsal vertebra.* A single entire depression on each side of the body.

9th, *Eleventh Dorsal vertebra.* Only one articular cavity on either side of the body; no articulating surface on the transverse apophysis.

10th, *Twelfth Dorsal vertebra.* The same characters; but the lower articular apophyses convex and turned outwards.

d.—OF THE VERTEBRAL COLUMN IN GENERAL.

65. *Dimensions.* We have already said that the twenty-four vertebræ united constitute the vertebral column, the length of which is nearly the same in all individuals, unless when it happens to be distorted in consequence of some malformation. In general, it is about a third of the whole length of the body, and the more ordinary dimensions of its different regions are as follows: the cervical 6 inches, the dorsal 12, the lumbar about 6¼.

It increases in thickness from above downwards, so as to represent a pyramid with its base below. But this increase of thickness is not perfectly graduated; and the general pyramid which it represents seems to be composed of three subordinate pyramids, of which the lower has its base on the sacrum, and its summit at the fifth dorsal vertebra, which is also the summit of the middle pyramid, whose base corresponds to the first dorsal vertebra. The summit of the third pyramid occurs at the level of the axis, and is surmounted by the atlas, which is much broader than the other vertebræ.

66. *Direction.* Anteriorly, the vertebral column is convex along the neck, concave at the back, and again convex at the loins. Posteriorly, the opposite curvatures are observed. This arrangement obviously depends upon the various degrees of thickness which the bodies of the vertebræ present before and behind in each of the regions of the spine.

These three curvatures, moreover, are so disposed that a vertical line passing through the centre of the summit and base of the vertebral column, would pass before the body of the dorsal vertebræ behind that of the cervical and lumbar.

There is also commonly a curvature observed on the sides of the dorsal region, which is much more frequently to the left. It has been attributed to the presence of the aorta; but Bichat imagined it with more probability to arise from the circumstance, that most exertions are performed with the right hand. Béclard has confirmed this opinion by recent observations. In left handed persons, the lateral curvature of the spine is on the right side, and consequently in the opposite direction to what it is in most other individuals.

In the sound state, the vertebral column inclines to neither side, so that a vertical line would divide it into two equal lateral portions.

67. *General form.* Considered as a whole, the vertebral column presents an anterior surface, a posterior, two lateral, a base and a summit.

68. The *anterior surface*, in the neck, where it is broad, is named *tracheal.* It contracts in the dorsal region, and is again enlarged in the lumbar, bearing successively the names of *predorsal* and *prelumbar.* Viewed in its longitudinal direction it is convex in the neck and loins, and concave in the back. A series of transverse hollows, more or less deep in the different regions, formed by the anterior surfaces of the bodies of the vertebræ, limited above and below by projecting margins, and extending toward the lateral parts in the back and loins, occupies the whole length of this surface, which is covered by the anterior vertebral ligament from above downwards, and which corresponds in the neck to the large anterior recti muscles of the head and the longi colli; in the back to the last mentioned muscles at first, then to the vena azygos on the right side, and the thoracic aorta on the left; and in the lumbar region to the crura of the diaphragm, the abdominal aorta, the vena cava abdominalis, and the nervous ganglia of the loins.

69. The *posterior surface* (*cervical* in the neck, *dorsal* in the back, *lumbar* in the loins,) presents in the median line, the row of spinous apophyses, which are horizontal above, inclined and imbricated in the middle part, and again horizontal in the loins. Their extremities are pretty generally placed in the same line; not unfrequently, however, one is inclined to the left and another to the right. The intervals by which they are separated are larger in the neck, and especially in the loins, than in the back. The spinous apophyses of the five last dorsal vertebræ gradually diminish in length, and become more and more horizontal; on which account the spine is more easily bent backwards at this place than at the upper part of the back. At the summit of the bony apparatus of which we are speaking, there occur in the place of one of these spines two small tubercles which give attachment to the small posterior straight muscles of the head.

On the sides of the range of those spinous apophyses are the *vertebral grooves*, wide above, contracted in the middle, and very narrow below, formed by the series of vertebral laminæ, and less deep in the cervical than in the dorsal and lumbar regions. They are filled by the longissimi dorsi, the sacro-lumbales, and semispinales dorsi and multifidi spinæ muscles, and disclose a series of apertures resulting from the separation of the laminæ. Of these apertures that which is situated between the head and the atlas is very large; in the rest of the cervical region and the upper part of the dorsal, they are scarcely apparent; but below this, and especially in the loins, they become very distinct. They are all, in the fresh state, closed by ligaments of a yellow colour.

At the outer side of these hollows, the posterior aspect of the vertebral column presents, in the neck and loins, the row of articular apophyses, and in the back, that of the transverse apophyses.

70. The *Lateral Surfaces* are in general straight. There are observed upon them the transverse apophyses, which have not all the same direction. Thus, in the neck and loins, they are placed in a plane anterior to those of the back. In the former of these regions, also, they are further distinguished by the sort of small canal which is formed for the vertebral artery by the series of holes with which their base is perforated, and in the dorsal region, by the articular surfaces which they present to the ribs. The transverse apophyses of the second lumbar vertebra are longer than those of the first and fourth, but shorter than those of the third. Along the whole extent of the spine, these apophyses give attachment to a great number of muscles; and they present holes between them, resulting from the union of the vertebral notches, which are named *holes of conjunction*. These holes, which afford a passage to the vertebral nerves, and which are proportionate in their diameter to the size of these nerves, are in the back and loins situated before the transverse apophyses, and not between them only, as in the neck. Their form is oval, and their passage very short. They are larger in the lower part of the spine. In the dorsal region, there is remarked before them the series of cavities which receive the heads of the ribs.

71. The *Base* is cut obliquely to be joined to the sacrum. With that bone it forms a sort of angle, named the *promontory* by accoucheurs, but which may with more propriety be termed the *sacro-vertebral angle*. This angle is salient anteriorly, retiring posteriorly, and straight on the sides.

The *Summit* of the vertebral column, which is articulated with the occipital bone, forms laterally with it two right angles, and presents a large hole, which is the commencement of the vertebral canal.

72. *Vertebral Canal*. This canal extends along the spine in its whole length, following its various curvatures, and placed nearer its posterior than its anterior part. Above, it is continuous with the cavity of the skull; below, with the sacral canal. From being

wide in the neck and in the upper part of the back, it afterwards contracts, to be again enlarged in the loins. It is triangular above and below, and rounded in the middle.

Anteriorly, it is formed by the posterior part of the body of the vertebræ, which is covered by the posterior vertebral ligament. Posteriorly, the vertebral laminæ, and the holes that occur between them, and on the sides, the inner part of the transverse apophyses and the holes of conjunction, are the objects which it presents.

73. *Uses.* The spine, which combines lightness with solidity and flexibility, serves to support the head and chest. It is the seat of all the motions of the trunk, of which it transmits the weight to the pelvis. It lodges and protects the spinal marrow and the membranes which envelope it. It gives passage to the spinal nerves and to many vessels. It affords insertion to a multitude of muscles and ligaments, both before and behind, such as the diaphragm, the latissimus dorsi, the sacro-lumbalis, the interspinales cervicis, &c. the ligaments which connect the two first vertebræ with the head, the last vertebræ with the pelvis, &c.

2. OF THE CHEST.

74. The *Chest*, (*Thorax*, *Pectus*,) is a large cavity of a conical form, somewhat flattened anteriorly, placed before the dorsal region of the vertebral column, composed of bones and cartilages connected by ligaments, and containing the principal organs of respiration and circulation. It is formed anteriorly by the sternum; on either side by twelve ribs; posteriorly by the dorsal vertebræ already described, which follow the median line behind between the heads of the ribs, as the sternum follows it before, between the two clavicles and the cartilages of the seven pairs of true ribs.

a. OF THE STERNUM, OR BREAST-BONE.—OSSA STERNI.

75. The *Sternum* is a symmetrical, elongated, flattened bone, undulated on its edges, thicker and broader above than below, and receiving the cartilages of the true ribs. Its direction is from above downwards, and it is inclined forwards, so that its lower extremity is anterior to the upper.

76. Its *anterior* or *outer surface*, which is covered by the integuments, and more immediately by the aponeuroses of the large pectoral and sterno-cleido-mastoid muscles, is marked with four more or less prominent transverse lines, which indicate the limits of the different pieces of which this bone is formed in early age. The two upper lines are more distinctly marked than the others. It is slightly rounded.

Frequently also this surface presents a hole, passing through the substance of the bone, which is the result of its mode of ossification, and which is in most cases closed up by a cartilaginous membrane, without its giving passage to nerves or vessels, although it is sometimes large enough to admit the end of the little finger. Du Laurens, Riolan, and some other anatomists, have erroneously considered this hole as occurring more frequently in women than in men; an opinion which experience does not confirm.

77. Its *posterior*, *inner*, or *mediastinal surface*, is porous, somewhat concave, and also presents the four lines mentioned above. At its upper part it gives attachment to the sterno-hyoid and sterno-thyroid muscles; on the sides, to the triangular muscles of the sternum; its middle part corresponds to the mediastinum, especially to the left.

78. The *upper* or *clavicular extremity of the sternum* (manubrium) is very thick, having a notch in the middle, in which the interclavicular ligament is situated, and is hollowed out on either side for the articulation of the clavicles, with a sigmoid cavity, which is lined with cartilage, shallow, and inclined outwards and backwards. It extends a little beyond the articulation of the first costal cartilage.

79. Its *lower* or *abdominal extremity* (corpus or body) bears a cartilaginous prolongation, which is subject to great variation of form in different individuals, being simple or bifurcated, pointed or obtuse, curved or straight, long or short, thick or thin, not unfrequently perforated by a hole for the passage of vessels and nerves, &c. This appendage, which is seldom wanting, is sometimes ossified. It is named the *xiphoid*, or *ensiform process*, or *appendage*. Its sides give attachment to the transverse muscles and the aponeuroses of most of the abdominal muscles, and at its anterior surface is inserted the costo-xiphoid ligament.

The lower extremity of the sternum descends far beyond the arculation of the seventh costal cartilage.

80. The *lateral edges* of this bone are thick, and present each seven articular cavities which receive the cartilages of the true ribs. The uppermost of these cavities is rounded and shallow. Its substance is evidently continuous with the first costal cartilage, over which the two compact laminæ of the sternum even project a little. The rest are angular, and correspond, by their bottom, to the lines of which we have spoken, which makes them appear deeper in the child than in the adult, because the bones of the sternum are not yet united. They are covered with articular cartilages, and separated from one another by notches, which are larger above than below, and which limit the intercostal spaces before.

A portion of the seventh articular cavity commonly occurs in the ensiform appendage; and this cavity is so close upon the sixth as to be nearly confounded with it.

81. The sternum which is covered with a thin layer of compact tissue, of a spongy and cellular structure internally, perforated by many vessels which constantly pour into it a great quantity of blood, and not unfrequently formed of two pieces united by a cartilage, and capable of moving slightly on each other, even at an advanced age, is articulated to the clavicles and to the cartilages of

the true ribs. It receives its development from eight or nine centres of ossification, and sometimes more.

Beclard, with great propriety, considers the sternum as composed of six principal bones, some of which, the first for example, are developed by two osseous nuclei. The fifth of these bones occupies the fifth intercostal space, together with the sixth, which is very narrow. The whole collectively appears to form a sort of chain.*

In about one subject out of fifty, there remains an aperture between the fourth and the fifth of these sternal bones, or between these two bones themselves; the sternum is proportionally longer and narrower in the female than in the male.

b.—OF THE RIBS.

82. The *Ribs (Costæ)* are irregular, very elastic bones, bent in various directions, raised at one of their extremities, flattened and rather thin before, rounded and thick behind, always articulated with the dorsal vertebræ, and often, but not always, with the sternum, which permits their being distinguished into two classes, viz. *true* or *vertebro-sternal* ribs, and *false* or *asternal.* There are seven true, and five false ribs, on each side. These are commonly designated by their numerical name, counting from above downwards.†

83. The length of the ribs gradually increases to the eighth, and then diminishes to the twelfth. Their breadth diminishes insensibly from the first to the twelfth.

The first is nearly horizontal. The others become gradually more inclined as they descend.

In general, the posterior part of the ribs is curved according to a line belonging to a smaller diameter than the fore part.

The first rib is also much nearer the axis of the chest than the others, which retire more and more from it as they descend. It represents a rather small and nearly regular semicircle. Those which follow, are less regularly curved, form a part of a larger circle, present a remarkable projection behind, and are twisted upon themselves, for which latter reason one of their extremities always rises when they are placed on a horizonal plane.

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* Beclard has given a particular name to each of these bones. The first, which the German anatomists have already named, *the handle (manubrium),* is his primi-sternal, or clavi-sternal; they become afterwards successively duo-sternal, tri-sternal, quarti-sternal, and ultimi-sternal, or ensi-sternal.

The attempt of M. Beclard to give a philosophical nomenclature to the bones of the sternum was, to say the least of it, imprudent and ill-judged; his knowledge of comparative anatomy was quite inadequate to the attempt. The mode of *determining* the various bones of the sternum, and of applying to them correct philosophical terms, is a subject infinitely above the reach of a mere teacher of human anatomy, and can succeed in the hands of the comparative anatomists only. K.

† It not unfrequently happens that the number of ribs is found to vary. There are never, however, more than thirteen on each side, or less than eleven. Sometimes this disposition exists on one side only. When the number of ribs is thus increased or diminished, the same phenomenon is observed with respect to the dorsal vertebræ

84. The *body of the ribs*, or their middle part, is flat, thin, convex externally, and concave within. Its outer surface presents posteriorly a tuberosity divided into two portions. The inner portion, which is convex and smooth, is articulated to the transverse apophysis of the dorsal vertebræ; while the outer gives attachment to the posterior costo-transverse ligament. More anteriorly, there is observed a projecting line, which is named the *angle of the ribs.* It is oblique outwards and downwards, and in the lower ribs is more distant from the tuberosity than in the upper. The sacro-lumbar muscle is inserted into it.

Between this angle and the tuberosity, there occurs a rounded, unequal surface, directed backwards, giving attachment to the longissimus dorsi muscle, and enlarging from above downwards.

Anteriorly to the angle, the outer surface of the ribs is smooth, and inclines a little upwards. It gives attachment to various muscles, the small pectoral, the serratus magnus, serratus posticus superior & serratus posticus inferior the obliquus externus of the abdomen, &c.

85. The *inner surface* of the body of the ribs is contracted at its middle part and inclined a little downwards, excepting at the angle, where it looks upwards and forwards. It is covered by the pleura.

86. The *upper edge* is blunt, and gives attachment to the two planes of the intercostal muscles. The *lower edge*, which is sharp and thin, and less inclined inwards than the other, is marked with a groove, deep behind, where it commences near the tuberosity, becoming superficial and internal before, and ceasing about the anterior third of the rib. It lodges the intercostal vessels and nerves, and gives attachment by its two edges to the muscles of the same name. Close upon the vertebræ one of these margins forms a rather remarkable prominence. It is named the *costal groove.*

In the first ribs, there is also observed, at the upper edge, a superficial vascular groove, which in like manner is obliterated as it advances forward, and which is wanting in the lower ribs.

87. The *posterior* or *vertebral extremity* of the ribs, is articulated to the spinal column, by means of a *head*, which is generally terminated by two cartilaginous facets, separated by a prominent line to which is attached a ligament, and corresponding to each of the half cavities in the body of the vertebræ. This head is supported upon a contracted and rounded *neck*, which rests upon the transverse apophysis, and gives attachment behind to the middle costo-transverse ligament.

88. The *anterior* or *sternal extremity*, which is thinner but broader than the posterior, and elongated from above downwards, is terminated by an oval surface for the reception of the cartilage, with which it is intimately connected. It is also softer than the other extremity, and presents a great number of vascular porosities.

89. The ribs are firm, elastic, and very hard; their centre and head are formed of cellular tissue, but the compact tissue which covers them has this peculiarity, that it seems formed of small scales, laid over each other and placed in layers.

90. These bones are developed by three points of ossification, one for the body, another for the tuberosity, and the third for the head. The epiphysis which is destined to form the tuberosity, is of a lenticular form; that of the dorsal extremity is a small angular plate. Both are still isolated at the age of eighteen or twenty.

c.—OF SOME PARTICULAR RIBS.

91. The first, second, eleventh, and twelfth ribs, present peculiar characters, and deserve a separate description.

1st. The *First Rib* is shorter, broader, and thicker than the rest, has a transverse position, and is a little curved from without inwards in the direction of its breadth. This rib presents on its *upper surface*, two furrows, which correspond to the sub-clavian artery and vein, and which are separated, near the inner edge, by an impression to which the scalenus anticus muscle is attached. Its *lower* surface, which inclines a little outwards, is slightly convex, smooth, and destitute of a groove. Its *inner edge* is concave, thin, and sharp. The *outer*, which inclines a little downwards, is convex, thicker, and rounder, and presents the tuberosity.

This rib is destitute of the angle. It also touches, with its two extremities, the horizontal plane on which it is placed. Its head is round, and presents only one articulating surface. Its neck is very slender and elongated. Its anterior extremity, which is broader and thicker than in the other ribs, sometimes affords insertion above to the sub-clavius muscle.

2d. The *Second Rib*, although much longer than the first, has nearly the same direction. Its *outer surface*, which is convex, and turned a little upwards, presents a *tuberosity* of which the uneven part is not very distinct, and a scabrous impression into which the serratus magnus is inserted. The *angle* scarcely exists. Its *inner surface*, which is smooth and concave, is turned downwards, and is only marked with a very short groove behind. Its *inner edge* is concave, thin, and sharp; the *outer* convex, thicker, and rounded. The *head* has two articulating surfaces.

3d. The *Eleventh Rib*, is short and destitute of tuberosity: it therefore has no connection with the transverse apophysis of the corresponding vertebra. Its angle is rather indistinct, and is placed far forwards. The head has only one articulating surface. The inner surface is destitute of a groove, and the anterior extremity is thin.

4th. *Twelfth Rib*. This rib is so short, that it seems to loose itself in the flesh, whence it has been called the *floating rib*. It is destitute of either tuberosity or groove, and has but one articulating surface. It therefore differs from the preceding, only in being extremely short, in wanting the angle entirely, and in having its anterior extremity attenuated.

d.—OF THE COSTAL CARTILAGES.

92. These cartilages correspond in number to the ribs, which they prolong anteriorly, affecting the same form and direction. They are the longest and thickest in the body, and their dimensions vary according to the rank which they hold. Their length increases from the first to the seventh, and then diminishes progressively to the last two, which are extremely short. Their breadth diminishes in a uniform manner from the first to the last. In the two upper cartilages, the breadth is generally equal in their whole extent; the rest become narrower as they advance toward the sternum. The sixth, seventh, and eighth form the only exceptions to this rule, touching each other at one part of their edges, where they are obviously enlarged.

93. The first cartilage, which might be considered as a *cartilaginous, anterior* or *sternal rib*, descends a little; the second is horizontal; the third is slightly inclined upwards; the fourth, fifth, sixth, and seventh, have at first the same direction as the rib, but quickly incline upwards to reach the sternum, their inclination being greater in the lower than the upper. The cartilages of the first three false ribs present this disposition still more evidently; but in the two last, the direction is the same as that of the ribs themselves.

94. The middle part, or body of these cartilages is slightly convex anteriorly, where it is covered by the great pectoral muscles, the obliquus externus and rectus of the abdomen, and moreover, in the first only, by the subclavius muscle and the costo-clavicular ligament which are inserted into it. Posteriorly, the body is a little concave. In the upper cartilages, it corresponds to the pleura and the triangular muscle of the sternum; in the rest, to the transverse muscle and the diaphragm. The *upper edge* is concave, the *lower* convex, both give insertion to the intercostal muscles. The great pectoral muscle also is inserted into the upper edge of the sixth. The edges by which the sixth, seventh, and eighth cartilages unite, present an oblong smooth surface at the points of articulation, where there is a general enlargement of their substance.

95. The *outer extremity* of all the costal cartilages presents a small convex uneven surface, intimately connected by union of substance, and like the synarthrodial cartilages, with the osseous portion of the rib. The *inner extremity*, in the true ribs only, is furnished with a convex, angular and projecting articular surface, which is received into the retiring angle formed by the cavities in the edges of the sternum. The first is evidently continuous with that bone; the six following are articulated to it by contiguous

diarthrosis. In the three first false ribs, this extremity is united to the cartilage which immediately precedes it. In the last two, it is isolated, pointed and thin, and is lost in the intermuscular cellular tissue.

The upper part of the sternal extremity of the first of all these cartilages gives attachment to the lower portion of the fibro-cartilaginous ligament of the sterno-clavicular articulation.

96. These cartilages seem at first sight to be homogeneous. They are white, very compact, somewhat flexible, and highly elastic. They dissolve with difficulty into gelatin. They have a great tendency to become ossified; and when this ossification, which is announced by the opaque tint which their perichondrium assumes, takes place, they present the same organization as the ribs themselves, only their substance is much more compact than that of the other bones of the skeleton. The cartilages of the asternal ribs ossify more slowly and less completely than the others.

97. By maceration during several months, they divide into oval laminæ or plates, separated by circular or spiral lines, connected by a few oblique fibres which they send off to each other, and subdividing into radiated fibrils, which are themselves ultimately separated into small fasciculi which at length dissolve into mucus.

They present neither cavities, canals, areolæ, fibres, nor laminæ, nothing in short indicative of an organic texture. They also appear to be destitute of nerves and vessels.

98. They are everywhere, excepting at their two extremities, enveloped by a somewhat vascular fibrous membrane or perichondrium, which is continuous with the periosteum of the ribs and sternum.

OF THE CHEST IN GENERAL.

99. *General Form.* The figure of this part of the skeleton is that of a truncated cone, somewhat flattened before and behind, and having its base below, excepting in some women, in whom the use of stays has much contracted this part of the body, and whose thorax then projects in the middle. This figure is very different from that which the chest presents when covered with its soft parts and connected with the shoulders, the upper part having then the appearance of being the broadest.

In general, the pectoral cavity is symmetrical, or, in other words, perfectly similar on both sides.

100. *Outer surface of the Chest. Anteriorly* it is contracted, more or less flat or prominent in different individuals, and generally better developed in women. It is somewhat oblique from above downwards, and from behind forwards. In the middle, may be observed the anterior surface of the sternum and the xiphoid cartilage; on the sides are seen the sterno-costal cartilages, which become longer the lower they are situated, and circumscribe spaces filled

up by the intercostal muscles. The two first of these spaces are broad—the rest gradually contract; but the two last resume a certain degree of breadth.

101. *Posteriorly*, this surface presents the two vertebral grooves, separated by the spinous processes, filled up by numerous muscles, and limited on the outside by the series of transverse dorsal processes, articulated with the tuberosities of the ribs. Still farther outwards, is a series of surfaces belonging to the ribs; and, lastly, a line interrupted from one rib to another by the intercostal spaces, having an inclination downwards and outwards, and formed by the angles of the ribs. The obliquity of this line is caused by the circumstance that the angles are more distant from the tuberosities in the lower ribs than in the upper.

102. On the *sides*, the outer surface of the chest is convex, especially at the back part, and presents the intervals by which the ribs are separated from each other. These intervals, from being short and broad above, diminish in breadth and increase in length, till we arrive at the one between the seventh and eighth ribs. After this they again diminish in length, to the last, which is very short. All these intercostal spaces are broader before than behind, and are occupied by muscles of the same name.

103. *Inner Surface of the Chest.* This surface, like the outer, presents *anteriorly* the posterior surface of the sternum in the middle, and the sterno-costal cartilages laterally. In this direction, it corresponds to the anterior mediastinum, and a little on the left, to the heart. *Behind*, it presents the bodies of the dorsal vertebræ, which by protruding seem to form a sort of imperfect partition, concave in the vertical direction, and contracting much the antero-posterior diameter of the cavity; on either side of the dorsal vertebræ, the ribs, by being much prolonged backwards, form a considerable elongated cavity, which is contracted above, broad beneath, and deeper in the middle. This excavation receives the posterior part of the lungs. *Laterally*, the inner surface of the thorax is concave, and formed by the ribs and intercostal spaces, as on the outside. Here it is contiguous with the lungs.

In general, the pleurae line almost everywhere the internal surface of the thoracic cavity.

104. The *upper circumference* of the thorax, which is usually called its summit, is small, transversely oval, and oblique in a direction from above downwards, and from behind forwards. It is constituted, posteriorly, by the vertebral column; anteriorly, by the sternum; on the sides, by the inner edge of the first rib. It is traversed by the trachea, the œsophagus, the arteries, veins, and nerves, which go from the chest to the arms and head, or which descend from these parts to the thorax. The sterno-hyoidei and and sterno-thyroidei muscles are inserted into it.

105. The *lower circumference*, or *base* of the thorax, is very large, especially in the transverse direction. It presents, anteriorly, a considerable notch, in the middle of which is the xiphoid car-

tilage, and which is formed laterally by the union of the cartilages of the false ribs, which constitute a sort of convex border, interrupted between the tenth, eleventh, and twelfth ribs on each side. Posteriorly, the base of the chest has also two small notches, which arise from the inclination of the last rib upon the vertebral column. It also descends much less lower before than on the sides and behind. It gives insertion to several of the abdominal muscles, and especially to the transverse muscles and the diaphragm.

106. *Direction of the Chest.* The axis of the cone represented by the thorax, or the ideal line which falls perpendicularly upon the middle of its base, is oblique from above downwards, and from behind forwards. But all the walls of the chest do not equally concur to produce the obliquity, which especially depends upon the circumstance that the anterior wall retires from the spine in proportion as it descends. There results from this, that a line ascending vertically from the centre of the base of this cavity, would not pass through the middle of its summit, but would pierce the upper part of the sternum.

107. *Dimensions of the Chest.* In the skeleton, the height of this cavity appears much greater than in the body invested with its soft parts, because, in the latter state, the diaphragm ascends pretty high in its interior. It is measured by means of certain ideal lines, which are named its *diameters*, and which pass from the sternum to the vertebral column, or from one side to the other. All the diameters are greater below than above. It is also observed, that the concavity of the vertebral column augments the dimensions of the antero-posterior diameters in the middle. It is far, however, from compensating the loss which they experience from the projection of the body of the vertebræ; so that these diameters are much greater laterally than in the median line.

The dimensions of the chest vary extremely in different individuals. They also experience great variations with relation to age or sex. The height of this part of the trunk is smaller, but its breadth is greater, in woman than in man.

108. Although, as we have already said, the thoracic cavity is generally symmetrical, in other words perfectly similar on both sides, it yet sometimes happens that one of its sides is more capacious and stronger than the other, and even that it forms a remarkable projection, without this phenomenon being attributable to any original malformation or to disease.

IV. OF THE HEAD.

109. The head, or cephalic extremity of the trunk, *(caput,)* is a spheroid, varying in size, more or less elongated and compressed in different individuals, which terminates the skeleton above, contains the brain and the principal organs of sense, and is articulated to the vertebral column. It consists of two parts, which are mani-

festly distinct in their uses, their mode of development, and their mechanism. These parts are the *Skull* and the *Face*.

1. OF THE SKULL.

110. The *Skull* or *Cranium** is a large ovoidal cavity, with its narrow end before, occupying the upper and posterior parts of the head, of a rather irregular although symmetrical form, which contains and protects the brain, and is formed of several flat bones, the edges of which are commonly marked with eminences.

These bones are:—anteriorly, the *Frontal;* posteriorly, the *Occipital;* on the sides and above, the two *Parietal Bones;* laterally and below, the two *Temporal;* below and in the middle, the *Sphenoid*, anteriorly to which is the *Ethmoid*, separated from it by the *Sphenoidal Turbinated Bones*.

Each of the temporal bones, moreover, contains four small bones: the *Malleus*, the *Incus*, the *Lenticular Bone*, and the *Stapes*. Very frequently, also, there are observed between the principal bones of the skull, other bones, which are very irregular in every respect, and which are known by the name of *Ossa Wormii*, or *Triquetral Bones*.

111. Four of the bones of the skull, the *Frontal*, *Occipital*, *Sphenoid*, and *Ethmoid*, are situated in the median line; the others are lateral. The former are symmetrical, that is to say capable of being divided into two perfectly similar parts, a character common to them with all the organs by the agency of which we become acquainted with external objects. These four bones, it is also to be remarked, are single, while the rest are in pairs.

All the bones of the skull do not belong to it so essentially as not to contribute also to the formation of the face; and for this reason they were divided by the older anatomists into *common* and *proper* bones. The latter belonged exclusively to the skull, and the frontal, occipital, parietal, and temporal bones were regarded as such; but this division is far from being correct, and we shall see, as we proceed, that several of these bones contribute as much to the formation of the face as the sphenoid or ethmoid.

112. The anterior region of the skull is named the *Forehead* or *Synciput;* the posterior, the *Occiput;* the upper part, the *Top* or *Bregma;* the lateral parts, the *Temples;* and the lower region, the *Base of the Skull.*

a. OF THE PARTICULAR BONES OF WHICH THE SKULL IS COMPOSED.

OF THE SPHENOID BONE.

113. *General Form.*—The *Sphenoid Bone* is articulated with

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* Κϱανιον of the Greeks; *calvaria* of the Latins.

all the other bones of the skull, which it sustains and unites.[*] It is on this account that we commence our description of the individual bones of the skull with it.

It is a single bone, symmetrical in its conformation, occupying the middle part of the base of the cranium. Its form is singularly irregular; the eminences and cavities with which it is marked are very numerous; and its uses are manifold. It is divided into the following parts.

114. *Guttural* or *Lower Surface.* This surface is very unequal, and presents on the median line a ridge, *(rostrum,)* more prominent before than behind, which enters into the upper edge of the vomer, and is continuous above with the septum of the sphenoidal sinuses. On each side, and from within outwards, it presents, 1*st*, A small groove which receives a plate of the vomer, and at the bottom of which is the orifice of a canal, very distinct in young subjects, which becomes obliterated with age, and which, passing obliquely through the wall of the sphenoidal sinuses, opens within the sphenoidal fissure, and gives passage to vessels. 2*dly*, Another small groove, which contributes to form the *Pterygo-palatine* canal, which also gives passage to vessels, and is completed by a process of the palate bones. 3*dly*, The *Pterygoid Process*,[*] an irregular projection, directed vertically downwards, contributing on the inside to form the posterior aperture of the nasal fossæ by a straight and smooth surface, which is lined by the pituitary membrane, and giving attachment on the outside to the external pterygoid muscle by a broader surface, which belongs to the zygomatic fossa. Anteriorly and beneath, it presents irregularities, which join the palate bones, and are surmounted by a smooth triangular surface, forming part of the same zygomatic fossa. Posteriorly, it is hollowed by the *Pterygoid Fossa*, broader below than above, into which is inserted the inner pterygoid muscle, and which in this direction divides the process into two laminæ, one of which, on the inside, gives attachment below to the upper constrictor muscle of the pharynx, and above, in a particular groove, called the *Scaphoid Depression*, to the external peristaphyline muscle. The pterygoid process is perforated above, from before backwards, by the *Vidian* or *Pterygoid Canal*, by which the nerves and vessels of the same name receive a passage. It finally bifurcates below, to receive the tuberosity of the palatal bones, and presents at the lower extremity of the inner branch of this bifurcation, which is narrower but longer than the outer, a small incurvation, called the *Pterygoid Hook*, over which is reflected the tendon of the outer peristaphyline muscle. 4*thly*, Externally, and behind the pterygoid processes, the *oval* and *small round holes*, of which we shall presently speak.

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[*] Whence its name, from the Greek word σφῆν, which signifies a wedge, it being in fact pressed by them on all sides, like a wedge driven into a solid body.

[†] Πτέρυξ, *ala*; ἔιδος, *forma*.

115. The *Upper* or *Cerebral Surface*, which is very uneven, is in connection with the membranes of the brain, and presents the following peculiarities.

On its middle part, and from behind forwards, there are observed, 1*st*, A thin quadrilateral lamina, inclined forwards, superficially notched on the sides for the passage of the external motory nerves of the eye, forming part of the basilar canal, and presenting at its two upper angles, two processes of a somewhat variable form, named the *Posterior Clinoid Processes*, which afford attachment to a replication of the tentorium cerebelli. 2*d*, The *Pituitary Fossa* or *Sella Turcica*, which is of a square form, deep, perforated with a considerable number of holes, having a direction towards the guttural surface of the bone, and whose use is not well known. Vieussens, however, says, he has been convinced by a great number of observations, that they give passage to small veins, which go from the coronary sinus of the dura mater to the pituitary membrane. It lodges the pituitary body. 3*dly*, Anteriorly to the sella turcica, a transverse groove, on which rests the junction of the optic nerves, and which ends at the optic holes, after curving a little forwards. 4*thly*, A smoothish surface, over which the olfactory nerves pass in two slight longitudinal depressions, separated from one another by a very superficial projection.

116. Laterally, and from behind forwards, we observe, 1*st*, The *small round* foramen for the passage of the middle meningeal artery. 2*dly*, In most cases, two or three small vascular apertures for the emissary veins of Santorini. 3*dly*, The *foramen ovale* or *lower maxillary hole*, for the passage of the third branch of the trifacial nerve. It perforates the bone directly from above downwards, and is sometimes double. 4*thly*, The *foramen rotundum*, or *upper maxillary hole*, which is a true canal, having a direction forwards, and giving exit to the second branch of the same nerve. 5*thly*, On the outer side of the foramen rotundum, a large concave surface, irregularly quadrilateral, marked with arterial grooves and cerebral impressions. 6*thly*, On the inner side, a broad groove, which lodges the cavernous sinus and the inner carotid artery, together with several important nerves. Anteriorly, this groove is terminated by a small prominence, to which is attached an aponeurosis, common to the inferior, internal and external recti muscles of the eye. There is often observed in this groove, on the sides of the pituitary fossa, a considerable hole, which descends to the upper part of the pterygoid fossa, and which also gives passage to an emissary vein of Santorini. At the foremost part there occurs, 7*thly*, The *orbital process* or *small wing of Ingrassias*, a triangular, depressed, transverse eminence, smooth above, where it corresponds to the anterior lobes of the brain; forming part of the orbit below; terminated before by an uneven edge, which unites with the lower margin of the coronal bone; behind, by a blunt free edge, which penetrates into a fissure of the brain; outwardly, by a pointed summit; internally, by a thicker part, in which there

is remarked, posteriorly, 8*thly*, The *anterior clinoid process*, which is sometimes prolonged to the posterior, and also gives attachment to a fold of the tentorium cerebelli; and, anteriorly, 9*thly*, The *optic hole*, a sort of depressed canal for the passage of the optic nerve and ophthalmic artery, directed forwards and outwards towards the orbit, beneath the wing of Ingrassias itself. Between this hole and the anterior clinoid process, there is observed a semicircular notch, which receives the internal carotid artery as it issues from the cavernous sinus. Sometimes, also, there is a particular hole for the ophthalmic artery. It is proper to observe also, that, most commonly, the base of the orbital process contains a sort of sinus, or small cavity, which opens on the side of the orbit by a narrow orifice, into which a slender branch of the ophthalmic artery enters, as Bertin has observed.

117. *Occipital* or *Posterior Surface.* This surface is of very small extent, and presents, at its middle part, a quadrilateral, uneven, rugose space, covered with cartilage in the fresh state, and at an early age. This space is destined to articulate with that which terminates the basilar process of the occipital bone; and, in the adult, it unites with it in an intimate manner, so that the two bones then form but one. In individuals in which this union has not taken place, there is observed, at each of the upper angles of this space, a small hook, which retains the basilar process.

118. On the sides, this surface is constituted by an irregular, thickish edge, presenting, near the quadrilateral surface, the posterior orifice of the vidian canal, narrower than the anterior, and surmounted by a small eminence, and continued toward the inner side, into a narrow groove, which is itself a continuation of the pterygo-palatine. A little to the outside, there are some asperities which, in conjunction with the anterior edge of the petrous portion of the temporal bone, form the foramen lacerum anterius.

119. *Orbito-nasal* or *Anterior Surface.* This surface is of greater extent than the preceding, and is vertically intersected in its middle by a thin prominent ridge, which is articulated with the ethmoid bone, and which forms a partition between two cavities, of which we shall presently speak. This ridge is surmounted by a small depressed and very thin process, which also joins the ethmoid bone; not unfrequently this eminence does not exist, and there is, on the contrary, a notch in its place.

120. On either side of this ridge, there is observed an aperture, with irregular lacerated edges, and varying in size in different subjects. These two apertures, which are articulated by their circumference, with the turbinated bones of the sphenoid, lead to two cavities formed in the interior of the bone, and named *sphenoidal sinuses.* These sinuses do not exist in young children, and are much larger in old people than in adults; for they then occupy all that part of the bone which is situated beneath the pituitary fossa, and the point of union of the processes of Ingrassias. The septum by which they are separated is sometimes incomplete, or

perforated by a hole, and is frequently deflected to the right or left, which produces a great difference in their respective capacity. Nor is it rare to find some other osseous laminæ, forming subordinate partitions, and thus dividing the sinuses.

121. Beyond the opening of the sinuses, there are found inequalities of greater or less extent, which serve to articulate the bone with the ethmoid above, and with the palate bone below. More externally, there occurs, on each side, an irregularly quadrilateral surface, which is directed inwards and forwards. This surface is smooth and plane, and enters into the constitution of the orbit, of which it forms the outer wall. It is surmounted by another triangular, rugose surface, which unites with the coronal bone, does and ~~is~~ itself surmounted by a horizontal, free, blunt ridge, which contributes to the formation of the spheno-maxillary fissure. It is limited, internally by a rounded edge, which belongs to the sphenoidal fissure, and which presents at its upper part a notch, or hole, for the passage of a branch of the ophthalmic artery; and externally by another very rough indented margin, which is articulated with the malar bone. The anterior orifice of the upper maxillary hole is observed beneath this surface and to the inside.

122. Two *zygomato-temporal* or *external surfaces*, inclined outwards and downwards, irregularly elongated, which are divided into two portions by a transverse ridge to which are attached the deepest-seated fibres of the temporal muscle. Above this ridge is a concave quadrilateral surface, marked with some arterial impressions and forming part of the temporal fossa. Beneath it there is another oblique surface, also concave, giving attachment to a portion of the outer pterygoid muscle, and continued into the pterygoid process. It belongs to the zygomatic fossa.

123. The cerebral and orbito-nasal surfaces of the sphenoid bone are separated from each other by an edge which may be named the *frontal*. It is directed outwards on each side, proceeding from the small process which surmounts the septum of the sinuses. This edge, which is uneven, and from being at first pretty thick is afterwards attenuated, is articulated with the lower edge of the frontal bone, and is interrupted, in its middle part, at the moment when it ceases to belong to the process of Ingrassias, by the very narrow entrance of a notch of considerable size and great depth, which is named the *Sphenoidal Fissure*, and which is limited by these apophyses above. It inclines downwards and inwards, is broader in the latter direction than outwards, and affords a passage to the ophthalmic branch of the fifth pair of nerves, the third, fourth, and sixth pairs, the optic vein, a branch of the lachrymal artery, or that artery itself in some cases, and lastly, to a prolongation of the dura mater. Beyond the sphenoidal fissure, the frontal margin of the sphenoid bone becomes again rough and uneven; it becomes very broad, and is articulated to the frontal bone by a triangular surface.

124. The cerebral and zygomato-temporal surfaces of the sphe-

noid bone are likewise separated by a margin which is concave, alternately sloped on its two lips, and presenting asperities which are articulated with the temporal bone. On being united with the preceding, this edge forms a very uneven surface, laid over the inner plate, and articulated with the anterior and lower angle of the parietal bone. Beneath, it is confounded with the occipital surface, and there gives rise to a pointed eminence, named the *Sphenoidal spine*, which gives attachment to the inner lateral ligaments of the articulation of the jaw and to the anterior muscle of the malleus. This process is received into a retiring angle, formed by the anterior edge of the petrous portion and by the circumference of the squamous portion of the temporal bone.

125. Until of late years anatomists generally distinguished in the sphenoid bone, the *Large Wings* and the *Body*. The former comprehended all the parts of the bone situated to the outside of the cavernous canals; the latter was confined between these two canals, and had a nearly cubical form.

126. *Structure.* In the centre, especially before the sinuses are developed, at the bases of the processes of Ingrassias and of the pterygoid processes, at the upper and outer part of what is named the *Large Wings*, the sphenoid bone is thick, and contains a great quantity of cellular tissue. In the rest of its extent, it is thinner and formed of compact tissue.

127. *Articulations.* The sphenoid bone is articulated with the frontal, ethmoid, occipital, parietal, and temporal bones, with the sphenoidal horns, the cheek bones, the palate bones, and the vomer, by the different parts that have been already mentioned; sometimes, moreover, this bone is articulated with the upper maxillary bones by inequalities which occur toward the union of the pterygoid processes with the orbito-nasal surface.

128. *Development.* The sphenoid bone is developed by seven points of ossification, which commence: 1st, at the centre of the bone; 2dly, at the base of each of the processes of Ingrassias; 3dly, at the place of junction of the pterygoid processes and the rest of the bone; 4th, in the inner wing of the same processes. The last mentioned nucleus is the *Omoid Bone* of Herissant.

In the fetus, the sphenoid bone evidently forms two distinct principal pieces, the one anterior or *spheno-orbital*, the other posterior or *spheno-temporal*, and which might be named *anterior sphenoid* and *posterior sphenoid bones.*

OF THE ETHMOID* BONE.

129. The *Ethmoid* (named also the *Cribriform*) *Bone* is placed at the anterior, lower, and middle part of the skull, in a notch formed in the frontal bone. It is symmetrical, has a nearly cubical form, and seems composed of the assemblage of a multitude of

* Ηθμος, *cribrum*; εἶδος, *forma*.

thin, fragile, semitransparent, papyraceous laminæ, placed in all sorts of directions, and thus constituting walls of cellules which vary in their form and size, and are more or less open externally, in different subjects. The object of these cellules seems to be the enlargement of the surfaces without increasing the bulk. This bone also, although of pretty considerable size, is very light.

Most anatomists consider it as formed of three portions: a middle and superior which they denominate the *Cribriform* or *Horizontal Plate*, on account of its perforations and position; and two lateral, named *Labyrinths.* We shall adopt Bichat's divisions, which are as follows:

130. A *cerebral* or *superior surface*, which is broad, very uneven, and lined by the dura mater; in the middle part, and posteriorly, is a small notch, sometimes a process horizontally flattened, which is articulated with a corresponding part belonging to the orbito-nasal surface of the sphenoid bone. A little more forwards, there is seen rising a triangular compressed eminence, varying much with respect to size and direction, sometimes very large and bulging, sometimes depressed and thin, vertical or deflected to either side, filled up or occupied internally by a small cavity, or sinus, which in some cases communicates with the sinuses formed in the substance of the frontal bone. This pyramidal process is the *Crista Galli* or *Ethmoid Crest.* It is continued by its base into the rest of the bone; its summit gives attachment to the falx of the brain; its posterior edge is elongated and oblique behind; its anterior edge short and vertical. It ends before in two small depressed eminences, which articulate with the frontal bone, and generally contribute to the formation of the foramen cœcum, of which we shall speak as we proceed. Its two lateral surfaces are plane and smooth.

On either side, externally of the pyramidal process, there is observed a wide and somewhat deep channel, corresponding to the olfactory nerves, much more distinct anteriorly than posteriorly, and perforated in its whole extent, but especially at the fore part, by round irregularly distributed holes, named the *Olfactory Foramina*, on account of their giving passage to the olfactory nerves, enveloped in small menyngeal sheaths.

131. These holes are of two kinds. Some are large and distinct, and are situated on the lateral parts of the channel, to the number of ten or twelve. The rest are very small and less numerous, and occupy the middle region. Each of them forms the superior orifice of a small canal, which subdivides as it descends into the interior of the bone, with the exception of most of those of the second order, which are true foramina, with a vertical or oblique direction.

Anteriorly to each of the olfactory channels, at the very base of the process, is a small longitudinal fissure, which is traversed by the internal branch of the nasal nerve.

132. More externally, there is observed on either side a quadrilateral tortuous surface, marked with several half cellules, which

are completed by corresponding portions of cellules, formed on the edges of the ethmoidal notch of the frontal bone, or by thin laminæ, belonging to the ethmoid bone itself. In the latter case, however, there is always one before, which remains open to meet the frontal sinuses. In the spaces between these cellules, are seen narrow grooves, which are converted by the frontal bone into canals, the external orifices of which assume the name of *internal orbital holes.*

133. A *Nasal* or *Inferior Surface.* This surface is covered over its whole extent by the pituitary membrane, and is so disposed that it can only be entirely seen after dividing the bone into two longitudinal portions. It is of a quadrilateral form, broader behind than before.

In its middle part, it presents a vertical plate, having a longitudinal direction, frequently deflected to either side, irregularly quadrilateral, and varying in extent. This is the *Perpendicular Plate of the Ethmoid Bone,* which forms part of the septum of the nasal fossæ, and is placed at right angles to the cribiform plate. On its lateral surfaces, which are lined by the pituitary membrane, it is marked by vascular and nervous impressions. Below, it is terminated by a blunt edge, which is articulated with the vomer and the triangular cartilage of the nose; anteriorly, by a margin thicker above than below, which in the former direction is connected with the nasal ridge of the coronal bone, and in the latter, with the nasal bones themselves; posteriorly, by another thin and sharp edge, which is articulated with the septum of the sphenoidal sinuses; while above, it is confounded with the cribiform plate. In its upper part, it is traversed by the internal olfactory canals. These canals, which are short and oblique before, vertical and elongated in the middle, very long, and inclined backwards posteriorly, become converted into mere grooves, and never descend lower than half the height of the plate. They are seen terminating by numerous apertures, having an oblique form.

134. To the right and left of the perpendicular plate, a deep narrow groove, more contracted before than behind, and frequently larger on one side than the other, leads to beneath the olfactory canals, of which it allows the middle holes and anterior fissures to be seen, and is limited externally by a very uneven surface, which presents various objects for examination. Behind and above, there is observed upon it a small thin plate, bent upon itself from above downwards, and most commonly from within outwards. This is the *upper turbinated bone* of the *nasal fossæ,* anteriorly to which is a square rugose surface, and beneath it a sort of horizontal channel, which forms part of the *superior meatus* of the same *nasal fossæ.* This channel occupies about the posterior half of the whole length of the ethmoid bone, and presents anteriorly an aperture which leads into the *posterior cells* of the bone, the number of which varies from three or four to ten, and which all communicate with each other, and are frequently closed behind by a bony

plate, but also frequently end in this direction, either with the turbinated bones of the sphenoid, or with the sinuses of the same name. They are lined by a prolongation of the pituitary membrane. Inferiorly, these parts are bounded by another bony plate, rugose at its surface, larger than the upper, more curved, thinner, and continuous above with the rest of the bone, free and thick beneath, especially at the fore part, convex interiorly, concave externally, and terminated behind by free inequalities. This plate is the *middle turbinated bone* of the *nasal fossæ* or the *ethmoidal turbinated bone.* Its lower edge is marked by a vascular groove, and it contributes, by its outer surface, to form a portion of the *middle meatus*, under the appearance of a longitudinal channel, anteriorly to which is a lacerated aperture, which leads to the *anterior ethmoid cells.* These cells are much larger and more numerous than the posterior, with which they have no communication whatever. One of them, named the *infundibulum*, situated behind the others, represents a sort of flexuous canal, directed forwards and upwards, widened beneath, where it corresponds to the aperture mentioned, and opening above into one of the half-cells, which are covered by those of the ethmoidal notch of the frontal bone, and which communicate with the frontal sinuses.

The ethmoid cells, anterior as well as posterior, are therefore completed above by the frontal bone, anteriorly by the upper maxillary bone and the lachrymal bone, behind by the palatine bone.

135. The outer olfactory canals, which are in general shorter than the inner, some of which are prolonged upon the middle turbinated bone, but of which there are none that penetrate into the meatuses or the ethmoid cells, occupy the greater part of the surface which we have just described, especially the superior turbinated bone, and the square surface which occurs before it. The numerous apertures of these canals, together with the presence of several vascular grooves, renders the inner surface of the turbinated bones very rough; but the outer surface, and the interior of the cells, are smooth and polished.

136. Lastly, the nasal surface of the ethmoid bone presents at its lowest part several variously recurvate, thin, fragile, and frequently unciform laminæ, which articulate with the opening of the maxillary sinus, and with some portions of cells formed above it; as well as with the inferior turbinated bone of the nose.

These laminæ generally break when they are disarticulated from the bones.

137. A *Sphenoidal* or *Posterior Surface.* This surface presents, in the middle, the posterior edge of the perpendicular plate, and, on each side, externally of the posterior extremity of the ethmoid grooves, a convex irregular surface, corresponding to the posterior ethmoid cells, articulated above with the sphenoid bone, beneath with the palate bone, and between the two, with the sphenoidal turbinated bone.

138. A *Naso-Maxillary* or *Anterior Surface.* This is of very

small extent, and presents, in the middle, the anterior margin of the perpendicular plate, and on each side, to the outside of the anterior extremity of the ethmoid grooves, portions of cells covered by the ascending process of the superior maxillary bone.

139. Two *Orbital* or *Lateral Surfaces.* These surfaces are quadrilateral, plane in the greater part of their extent, and cut obliquely at their anterior and posterior extremities. The latter presents several portions of cells which complete the sphenoidal turbinated bones and the palate bones; the other leaves exposed the greater part of the anterior cells, which are overlapped by the lachrymal bone.

At the middle part of each of these surfaces there is observed a square plate, the *os planum* of the older writers, which forms a large portion of the inner wall of the orbit. It is smooth and polished, and is articulated above with the frontal bone, behind with the sphenoid, and before with the lachrymal bone. The upper edge of this bony plate often presents small notches, which concur in forming the internal orbitary holes.

140. *Structure.* The ethmoid bone is almost entirely formed of compact tissue, presenting no appearance of cellular tissue, excepting in the turbinated bones, the crista-galli and the perpendicular plate.

141. *Articulations.* It is articulated to the frontal and sphenoid bones, the sphenoidal turbinated bones, the upper maxillary bones, the palate bones, the lower turbinated bones of the nose, the vomer, and the nasal and lachrymal bones by the different points which have been successively described.

142. This bone contributes at once to form the base of the skull, the orbits and the nasal fossæ.

143. *Development.* It presents three centres of ossification, one for its middle part, and two for the lateral regions, the latter appearing at an earlier period than the first. The cells form only at an advanced age, and in young subjects it is solid, full, and entirely cartilaginous. The turbinated bones do not make their appearance until about the age of seven years.

OF THE SPHENOIDAL TURBINATED BONES.

144. *Form.* The *Turbinated Bones of the Sphenoid* (*Cornua Sphenoidalia* of Soemmering, *Cornets* of Bertin) are two thin small bones, curved upon themselves. They have the form of a hollow pyramid, with its summit turned behind, and are situated at the base of the skull, between the sphenoid and ethmoid bones, with which they become confounded in adults. From this latter circumstance they are not commonly described as distinct bones; but as they are developed by a particular point of ossification, unite indifferently with the ethmoid or sphenoid bones, and as this union takes place only at an advanced age, like that

below with the palate and superior maxwhich is formed between the basilar process of the occipital bone and the sphenoid, they must necessarily be considered as distinct.

145. The base of the triangular pyramid represented by these bones is adapted to the posterior part of the lateral masses of the ethmoid bone in such a manner as to close the corresponding cells, permitting them, however, by means of a notch or a rounded aperture, to communicate with the sphenoidal sinuses. Its summit, which is pointed and hard, is inserted in a groove situated near the base of the pterygoid process, and is in part concealed by the posterior process of the palate bone. The lower surface forms part of the nasal fossæ. Most commonly it furnishes an irregular papyraceous prolongation, which passes under the sphenoid bone, and proceeds toward the inferior ridge of that bone, directing itself toward that of the opposite side, to be united with the upper edge of the vomer. The outer surface is open above, to correspond to the entrance of the sphenoidal sinuses. Below, it concurs with the palate bone, in forming the *spheno-palatine hole*, which, in young subjects, does not in any way belong to the sphenoid bone, whose name it bears. This surface, moreover, frequently sends a thin lamina into the interior of the sinuses, and seems, as it were, to line its walls. Frequently also the floor of these cavities is entirely formed of the bones in question.

146. *Structure, Articulations, Development.* The sphenoidal turbinated bones, which, I believe, were first described by Bertin, are entirely compact and hollow, with the exception of the summit alone, which contains a little cellular tissue.

They articulate with the sphenoid and ethmoid bones, the palate bone and the vomer; and are developed by a single point of ossification, generally after birth, although it is not rare to meet with their rudiments in fetuses of the seventh or eighth month. About the age of from twelve to fifteen, they unite first with the sphenoid bone, and at a later period with the ethmoid.

OF THE FRONTAL OR CORONAL BONE.

147. *Form.* This bone is symmetrical, of a more or less semicircular form, convex and smooth anteriorly, concave posteriorly, and very unequal below. It is divided into the following parts.

148. *Orbito-ethmoidal Surface.* This surface, which is uneven and turned downwards, presents in the middle a broad quadrilateral notch, which receives the ethmoid bone, and is accordingly named the *ethmoid notch.* Around this notch there are observed anteriorly the *nasal spine* and the orifices of the frontal sinuses; on the sides, portions of cellules, which unite with similar portions belonging to the ethmoid bone. There are two or three small transverse apertures formed between these cellules, which contribute to form the *internal orbitary canals.*

149. To the right and left of the ethmoidal notch, there is observed a triangular concave surface, which forms the vault of the orbit, and which presents, anteriorly and to the outside, a small cavity which receives the lachrymal gland; in the same direction, and to the inside, a slight inequality to which is attached a cartilaginous pulley by which the tendon of the large oblique muscle of the eye is reflected.

150. *Frontal, Anterior,* or *Pericranial Surface.* This surface is marked, in the median line, with a longitudinal depression, commonly not very distinct, and occupying the place where the two portions of which the bone consisted at an early age are united. Previously to their uniting, a suture is always observed in this place; and not unfrequently the two pieces are not intimately united, so that the suture exists even at the most advanced age. At the lower part of this line is the *nasal prominence,* which is much larger in old than in young persons, and is generally perforated by a great number of small holes. Farther down there is seen a notch of the same name, which is articulated with the nasal bones in the middle, and on the sides with the nasal apophyses of the superior maxillary bones. This notch itself surmounts the *nasal spine,* on the sides of which are two small longitudinal grooves, forming part of the nasal fossæ. The nasal spine is articulated anteriorly to the nasal bones, and behind the vertical plate of the ethmoid bone.

151. On either side, and proceeding from above downwards, we observe a broad and smooth surface, which is covered by the frontal muscle; the *frontal prominence,* which is very distinct in children; a slight depression; a transverse eminence, slightly curved, more prominent internally than outwards, named the *superciliary arch,* from its corresponding to the eyebrow, and giving attachment to its muscle; another prominent line, also curved, which proceeds from both sides of the nasal groove, and is named the *orbital arch.* It is terminated by two apophyses of the same name. The outer of these processes, which is thick and prominent, joins the malar bone; while the inner, which is thin and broad, is articulated with the lachrymal bone. On the inner ~~side~~ third of this arch, there is observed a hole, or a notch converted into a hole by a ligament, which is called the *supra-orbital foramen,* and which gives passage to the frontal vessels and nerves. On the margin of this hole, there is another much smaller, and forming a mere pore, which allows an arterial branch to penetrate into the coronal sinus.

152. On the outside of this surface, above the external orbital process, there is seen a prominent line, which is curved, and runs in a direction upwards and backwards. It forms the limit of a small surface which constitutes part of the temporal fossa, and gives attachment to the temporal muscle.

153. *Cerebral, posterior, or internal surface.* This surface is concave, being in contact with the dura mater, and is marked in

the middle with a groove, in which is lodged the commencement of the superior longitudinal sinus of that membrane. The margins of this groove unite below, forming a ridge, to which the summit of the falx cerebri is in part attached, and which terminates at a hole called the *foramen cæcum.* The uses of this aperture are not yet well known. Sometimes it is completed by the ethmoid bone.

154. This surface of the bone also presents on each side a great number of inequalities, which correspond to the windings and circumvolutions of the brain, at least in part; for, as Bichat has remarked, it is often a prominent portion of the brain that corresponds to an eminence on the bone, and *vice versâ.* These inequalities are commonly named *mamillary eminences* and *digital impressions.* There are also observed upon it several arterial furrows, and the *coronal* or *frontal fossæ,* which correspond to the prominences of the same name.

155. *Upper margin.* This margin is thick, uneven, more than semicircular, cut obliquely at the expense of its inner plate above, and of the outer below. It is articulated with the parietal bones in such a manner, that, with the aid of this obliquity of its edge, it rests upon them above and supports them below. It terminates on each side by a broad rough triangular surface, which joins the great wings of the sphenoid bone.

156. *Lower margin.* This is straight, thin, interrupted in its middle part by the ethmoidal notch, and cut obliquely so as to sustain the small wing of the sphenoid bone.

157. *Structure.* The frontal bone is pretty thick towards the nasal protuberance and the external orbital processes, but very thin and even diaphanous in its orbital region. It is formed of diploe contained between two compact laminæ, and presents in its substance two cavities, which bear the name of *frontal sinuses.*

These sinuses, which vary in size in different subjects, not being yet developed in childhood, while they are very large in old people, have their orifice anterior to the ethmoidal notch, and from thence proceed, at the same time enlarging, into the frontal region of the bone, sometimes even extending into the external orbital processes. They are separated from each other by a septum, which, however, is sometimes wanting. It is seldom that they are wanting altogether. They communicate with the anterior cellules of the ethmoid bone.

158. *Articulations.* The frontal bone is articulated with the parietal bones, the sphenoid and ethmoid bones, the nasal bones, the upper maxillary bones, the lachrymal bones, and the malar bones.

159. *Development.* Its development takes place by two points of ossification, which begin, about the forty-second day of gestation, to make their appearance on the coronal prominences, or rather in the orbital arches, and from thence send out radii towards the circumference of the bone. It was formerly asserted that these two

bony points give rise to a suture, which, at an advanced age, is more frequently observable in women than in men. This assertion, however, is erroneous; for it is as frequently met with in adults in the one sex as in the other. The suture in question generally disappears a few years after birth, although not at any very regular period.

OF THE OCCIPITAL BONE.

Form. The *Occipital Bone* is flat, symmetrical, of a rhomboidal form, and curved upon itself. It is situated at the posterior, middle, and inferior part of the skull, and is divided into the following parts.

161. *Occipital* or *Posterior Surface.* This surface is convex. There are observed upon it, in the median line proceeding from below upwards: 1st, A rough surface, nearly horizontal, lined by the membrane of the pharynx, giving attachment to the large and small anterior recti muscles of the head. It is called the *Basilar Surface.* 2dly, The *Occipital Hole,* which is of an elliptical form, nearly horizontal with its greatest diameter placed from behind forwards, and gives passage to the spinal marrow, with the prolongation of the cerebral membranes by which it is enveloped, and the vertebral arteries and spinal nerves. 3dly, The *Outer Occipital Ridge,* into which is fixed the posterior cervical ligament. 4thly, Above the latter part, the *Occipital Protuberance,* situated nearly in the middle of the space which separates the occipital hole from the upper angle of the bone, and more or less prominent and uneven. Between this angle and the protuberance there is a convex surface, which is covered by the epicranial aponeurosis.

162. On either side, and in the same direction, there is observed the *Condyle* of the occipital bone, an articular convex eminence, of an oval form, elongated from behind forwards and from without inwards, covered with cartilage, uneven on the inner side for the attachment of a ligament which comes from the odontoid process, limited outwardly by a surface into which is inserted the rectus ~~externus~~ laterales capitis, and marked behind and before with two cavities which are named the *Fossæ of the Condyles,* and which are distinguished into *anterior* and *posterior.* Both are perforated, at their bottom, with a hole which bears the same name. The first of these two holes gives exit to the hypoglossal nerve; the other is traversed by arteries and veins, and is sometimes wanting, a circumstance never observed with respect to the first, which is even in many cases double. Beyond the condyle are impressions for the attachment of the great and small posterior recti and obliquus superior capitis, which are situated under a *curved line* called the *inferior,* pretty distinct, and surmounted by other impressions, into which are fixed internally the complexus magnus, externally the splenius, and by a second *curved line* called the *superior,* which

receives the insertions of various muscles, viz. internally, the trapezius; in the middle, the occipital muscle; externally and beneath, the sterno-cleido-mastoideus, and which has above it a smooth triangular surface, over which the occipital muscle lies.

163. *Cerebral* or *anterior surface.* This surface is concave, unequal, and immediately connected with the dura mater. It presents in the middle, and from below upwards: 1st, a broad groove inclined backwards, which sustains the annular protuberance, and which is named the *Basilar Groove;* 2dly, the internal orifice of the great occipital hole, wider than the outer; 3dly, the *Inner occipital Crest*, bifurcated below, and giving attachment to the falx cerebelli; 4thly, the *Internal occipital protuberance*, sometimes substituted by a depression, and in which terminates; 5thly, a channel which descends on one side or the other, more commonly on the right, and which lodges the end of the superior longitudinal sinus of the dura mater.

164. On either side, and in the same direction, there occurs a small channel on the edge of the basilar groove, which lodges the inferior petrous sinus of the dura mater. In the very margin of the great occipital hole are the internal orifices of the anterior condyloid foramina, covered by a bony eminence, on the outside of which is a portion of a canal directed inwards and backwards, which lodges the end of the lateral sinus of the dura mater, and contains the internal orifice of the posterior condyloid foramen. This portion of canal is surmounted by, 6thly, the *Inferior occipital Fossa*, which lodges the corresponding lobe of the cerebellum, and which is itself surmounted, 7thly, by the *Lateral Transverse Channel*, which, proceeding from the occipital protuberance, is continuous with the median groove, sometimes on both sides at once, but more commonly on the right side only, although the reverse has also been observed. It receives the commencement of the lateral sinus of the dura mater. Above it is observed, 8thly, the *Superior Occipital Fossa*, smaller than the inferior, which receives the posterior lobes of the brain, and whose surface is marked with distinct mamillary eminences and digital impressions.

165. The two surfaces of the occipital bone are separated from each other by the *Edges*, which, in uniting, form angles more or less acute. Two of these edges are *inferior*, and present anteriorly an elongated surface, not very well defined, which belongs to the side of the basilar process, unites with the inferior edge of the petrous bone, and is limited behind by a deep notch which concurs to form the foramen lacerum posterius. Sometimes this notch is divided into two portions by a small bony tongue which the temporal bone also occasionally supplies. Beyond this is a square eminence, covered with cartilage, which is articulated to the temporal bone, and is named the *Jugular process.* It seems to divide this edge into two nearly equal parts, of which one has just been described, the other, which is situated higher, is concave, more

deeply indented, and articulates with the mastoid portion of the temporal bone.

166. The *Superior Edges* present numerous points, together with deep, very irregular, and frequently very large notches, and articulate with the parietal bones. They also frequently present ossa Wormii entangled in their serratures. The angle which these two edges form by their junction is generally acute; it is often, however, truncated, and in that case a triquetrous bone of considerable size occupies its place. The two lateral angles resulting from their union with the lower edges are much more obtuse, and are articulated with the mastoid portions of the temporal bones.

167. A square rough surface, covered with cartilage, seeming to intersect the basilar process anteriorly for the purpose of articulating it to the posterior surface of the sphenoid bone, is formed by the two inferior edges of the occipital bone, at the moment when they approach each other anteriorly.

168. *Structure.* The occipital bone is rather thin over the greater part of its extent, being only decidedly thick at the condyles, the basilar process, and toward the ridges and protuberances. In these places also the tissue is cellular, whereas in the middle of its fossæ, it is entirely composed of compact tissue, and is there so thin as to be semitransparent. As in the other bones of the head, there is also a layer of compact tissue extended over both surfaces. This bone may nevertheless be considered as the hardest and thickest of those which enter into the composition of the cranium, at least next to the petrous bone. Its softer parts are effectually protected on the outside by a great depth of muscular substance.

169. *Articulations.* The occipital bone is articulated to the sphenoid bone, the temporal and parietal bones, and the atlas, by the various points already mentioned.

170. *Development.* In the fetus the occipital bone, whose ossification is of the most complex nature, appears to be formed by four centres, which commence at the basilar surface, at each condyle, and at the external protuberance. These four pieces form at that period so many distinct bones, and have been described as such under the names of the *proral* or *squamous occipital*, *condyloid* and *basilar bones.* From these different points the fibres radiate in all directions, and meet, on the one hand, behind the great occipital hole, and on the other, at the middle part of the condyles. But if the bone be examined long before birth, it is discovered that the occipital portion properly so called, or that situated above the condyles, owes itself its development to four osseous nuclei which unite at the protuberance, and which are but a short time distinct from each other, especially the two upper. At that period also, but only in some subjects, there occurs between the posterior extremities of the condyloid points, in the inferior notch of the occipital portion, a particular nucleus which completes the vertebral ring behind.

OF THE TEMPORAL BONE.*

171. *Form.* The Temporal Bones (ossa temporum) are of a form which it is difficult to define, presenting a great number of eminences and cavities, containing in their interior the organs of hearing, and occupying the lateral and inferior parts of the cranium. Each of these bones is commonly considered as resulting from three distinct portions, although in reality it forms a continuous whole, and consists of only a single piece. The three portions thus admitted by anatomists are the *squamous portion* externally, the *mastoid portion* behind, and the *petrous portion* beneath and within. We distinguish in the temporal bone the following parts.

172. An *auricular* or *external surface.* It is slightly convex, smooth, and entirely situated at the outside of the skull. At its anterior and upper part, it presents a pretty broad surface, marked by several grooves in which branches of the deep temporal arteries are lodged. It gives attachment, nearly over its whole extent, to the temporal muscle, and forms part of the temporal fossæ. Beneath, there is observed a strong process, broad at its commencement, but gradually diminishing, at first directed horizontally outwards and forwards, but soon preserving the latter direction only, and twisting upon itself as it removes from the rest of the bone, so that its surfaces, from being horizontal, become vertical. This is the *Zygomatic Process*, of which the upper edge is thin and straight, giving attachment to the temporal aponeurosis; while the lower edge, which is thick, concave, and much shorter than the other, serves, as well as the inner surface, for the insertion of the masseter muscle. Its outer surface is convex, and lies immediately beneath the skin. Its extremity is cut obliquely downwards and backwards, and presents indentures like teeth which articulate with the malar bone. Its base, which is turned backwards, and hollowed above by a superficial groove, in which a great part of the fibres of the temporal muscle slide, bears below a blunt and low tubercle, to which is attached the external lateral ligament of the articulation of the lower jaw, and which gives rise to two prolongations named the *Roots of the Zygomatic Process.* One of these roots, (the *Temporal Condyle* of Chaussier,) which is inferior, transverse, concave inwards and outwards, convex from before backwards, and covered with cartilage, serves for the articulation of the lower jaw; the other, which is superior and longitudinal, is directed backwards, and divides into two. Its upper subdivision, by describing a curve, gains the circumference of the bone; the lower descends a little inwards, and terminates at the outer extremity of a very narrow fissure which penetrates into the cavity of the tympanum, and which is named the *Glenoid Fissure.* Through this

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* The Temporal Bones have been so named on account of their occupying the region of the head on which the hair generally first begins to turn grey, thus indicating the various periods of age, *(tempora.)*

fissure there pass the tendon of the anterior muscle of the malleus, some vessels, and a nerve called the *Cord of the Tympanum.*

173. This fissure, passing inwards and a little downwards, divides into two portions the *Glenoid Cavity* of the temporal bone, which is a sort of shallow fossa, turned downwards, outwards, and forwards, of an irregularly oval form, circumscribed externally by the superior root, and anteriorly by the transverse root of the zygomatic process, so that it seems to occupy the interval which exists between them. The anterior portion of this cavity is covered with cartilage in the recent state, and is articulated with the condyle of the lower maxillary bone. Its posterior portion, which is less smooth and less concave, is covered with periosteum, and does not form part of the joint.

174. Behind and to the outside of the glenoid cavity, between the two divisions of the upper root of the process, is seen the orifice of the *external auditory canal, (meatus auditorius externus.)* This canal seems formed of an osseous plate twisted upon itself, blending above with the rest of the bone, and forming below an unequal rugged edge, more or less prominent, which gives attachment to the cartilage of the ear. On this account the entrance of the meatus always appears lacerated at its lower part. The canal itself has a direction from behind forwards and from without inwards, is a little curved downwards, ~~wider~~ narrower in the middle than at the two extremities, opens into the cavity of the tympanum, and is lined with a prolongation of the skin. Its length is about nine lines. Above and behind, it terminates sooner than below and before. In the fetus, it is substituted by a bony circle separated from the rest of the bone and interrupted above.

175. Beyond the meatus auditorius there is observed a conical eminence, named the *Mastoid Process* on account of its form, which has been compared to that of a nipple. It is much more prominent in old people than in young subjects, has a rough and granular surface, is more or less obtuse, more or less straight or curved, more or less convex, and is sometimes terminated by a sort of scale. It gives attachment to the sterno-cleido-mastoideus, and is surmounted by a rough surface, into which that muscle is inserted, together with the splenius and small complexus. It is here that the *Foramen Mastoideum* commonly occurs, although it varies much in its position, being sometimes met with in the occipital bone, and not unfrequently in the suture by which that bone is joined to the temporal. It gives passage to an artery and an emissary vein of Santorini. Sometimes it is wanting on one side, and occasionally there are three or four in each bone. To the inside of the mastoid process is a longitudinal depression named the *Digastric Groove*, on account of its giving attachment to the muscle of that name, and another groove, less deep, for the small complexus muscle.

176. A *Cerebral* or *Internal Surface.* This surface presents at the upper part a space which is obliquely cut, deeply striated,

covered with numerous asperities, and destined to unite with the lower edge of the parietal bone. This surface is much broader in its middle part than behind, and especially than before, where it it confounded with the circumference of the bone. Under it there is observed a concave uneven space, marked with several arterial furrows, and covered with those eminences and impressions which we have already several times remarked on the inner surface of the bones of the skull.

177. A pyramidal, triangular process, having its summit directed forwards and inwards toward the sphenoid bone, and slightly inclined in that direction, rises from the middle of the cerebral surface of the temporal bone. It is the *Petrous Process* or *Pyramis*, in which, on account of its form, there are distinguished: 1st, An *upper surface*, which presents in its middle a small irregular aperture, named *Hiatus Fallopii*, through which a nervous filament from the spheno-palatine ganglion, and a small artery, are transmitted to the Fallopian tube. Anteriorly to this hole, there is observed a small single or double groove, which is straight and shallow, and lodges the nerve and artery just mentioned. Behind it is a very prominent protuberance which indicates the position of the superior semicircular canal. The whole surface, moreover, is covered with cerebral impressions. 2dly, A *posterior surface*, lined like the preceding, by the dura mater, and on which there is seen, at its upper and fore part, a wide oblique aperture, with rounded edges, which is the orifice of a canal named the *internal auditory, (meatus auditorius internus.)* This canal, ~~which is the entrance of~~ the aqueduct Fallopi~~an~~us ~~tube~~, has a direction forwards and outwards, passes through about two-thirds of the substance of the petrous process, and is abruptly posterior terminated by a vertical bony plate, in which there is a small fissure for the passage of the facial nerve. Beneath this fissure is a sort of crest, which surmounts a number of pores, giving passage to the filaments of the acoustic nerve. Behind the aperture of the meatus auditorius internus, there is observed a shallow irregular cavity, narrower in young persons, into which is fixed a prolongation of the dura mater. Behind this is seen a narrow, triangular, and very short slit, in which the aqueduct ~~canal~~ of the vestibule terminates. A pretty distinct groove descends from this slit toward the jugular fossa, of which we shall presently speak. This surface is marked with impressions similar to those which we have observed on the upper, from which it is separated by a blunt edge, presenting internally a semilunar depression, on which rests the trifacial nerve, and marked in its whole length with a superficial channel, in which is lodged the superior petrous sinus of the dura mater. 3dly, A very complex *inferior surface*, placed on the outside of the cranium. Internally, it presents a very rough space into which are inserted the fibres of the inner peristaphyline and internal ~~external~~ muscles of the malleus, and which is bounded externally by the orifice of the *carotid canal*, and by a cavity which occurs behind it. This cavity is named the

and which is the entrance to the aqueduct of Fallopius.

jugular fossa, and lodges the commencement of the jugular vein. It is limited externally by a small quadrilateral surface, covered with cartilage in the recent state, and articulated with the jugular process of the occipital bone, which presents between it and the mastoid process, a hole named the *stylo-mastoid foramen.* This hole is round, and placed in a very distinct cavity, which often partly conceals it. It terminates the *Fallopian canal* and transmits the facial nerve from the ~~brain~~ cranium. Before this aperture, and a little to the inside, there is observed a slender elongated and pointed eminence, more or less curved, twisted, or knotty, descending obliquely forwards. This is the *styloid process*, which derives its name from its form, and gives attachment to the stylo-hyoideus, stylo-glossus, and stylo-pharyngeus muscles, and to the stylo-maxillary and stylo-hyoid ligaments. This process, which in early age is not united to the rest of the bone, and is then articulated to the petrous process by the intervention of a cartilage, is surrounded at its base by a bony lamina, which is most prominent on the inside. This is called the *vaginal process*, and forms the posterior limit of the glenoid cavity.

178. Such are the various objects presented by the lower surface of the petrous portion of the temporal bone, which is separated from the upper surface by a very short edge, articulated with the sphenoid bone, and not very distinct on account of its irregularity, and from the posterior by an unequal edge, in which there is seen posteriorly a notch, frequently divided into two portions by a small bony plate, and concurring with the occipital bone to form the foramen lacerum posterius. At the middle of this edge is a triangular aperture, which is the external opening of the canal of the cochlea, and which also sends a groove toward the jugular fossa internally; this edge is connected with the occipital bone.

179. The summit of the petrous process is formed by the union of its three surfaces. It is very uneven, obliquely truncated, and sometimes partly formed by a triquetrous bone. A portion of the circumference of the anterior lacerated hole belongs to it. Lastly, it presents the internal orifice of the carotid canal, which is still more uneven at its margin than the outer, and varies much as to its form in different subjects. This canal gives passage to the internal carotid artery, together with several small nerves. At its commencement, it is directed vertically upwards, then bends, and proceeds horizontally inwards and forwards toward the internal orifice.

180. The *Aqueduct of Fallopius*, whose commencement we have already pointed out in the bottom of the internal auditory canal, and which we have seen terminating in the stylo-mastoid foramen, is a narrow canal, remarkable for its length, which transmits the portio dura of the seventh pair of nerves. Immediately after its commencement, it ascends outwards and backwards, to the upper part of the petrous process, where it is perforated by the *hiatus fallopii;* it then proceeds directly backward over the cavity of

the tympanum, and descends first obliquely, then vertically, into the inner wall of that cavity, to end in the stylo-mastoid hole. This canal is lined by a very thin fibrous prolongation, and perforated in its passage by several apertures, independently of that of the hiatus Fallopii. Bertin has mentioned one at the level of the latter, but much smaller than it, and opening into one of the semicircular canals. M. Jacobson has lately described another which leads into a groove, or according to Beclard, into a canal formed on the promontory of the tympanum. It contains an anastomosis of the glosso-pharyngeal nerve, with a filament of the spheno-palatine ganglion and of the carotid plexus. Lastly, farther on this aqueduct gives rise to a canal which transmits the cord of the tympanum, and to some small canals for nervous filaments which are distributed to the muscles of the small bones of the ear.

181. Behind the petrous process, and always on the cerebral surface of the temporal bone, there is observed a pretty deep fossa, in the form of a channel, which presents the internal orifice of the mastoid hole, and lodges a portion of the lateral sinus of the dura mater.

182. *Circumference.* It commences by a retiring angle, at the place where the anterior edge of the petrous process unites with the rest of the bone. This angle, which receives the sphenoidal spine, presents at its bottom two apertures, separated by a bony lamina, and placed one above the other. The upper, which is less marked, gives entrance to the inner muscle of the malleus; the lower is the orifice of the bony portion of the *Eustachian Tube.* After this it is cut obliquely at the expense of its outer surface, is thick and toothed, and articulates with the sphenoid bone, directing itself forwards and upwards. It then becomes thin and sharp, and proceeds backwards, describing a semicircle. Here it is articulated with the parietal bone, and forms what is called the *Squamous Suture.* Above the mastoid process it is again marked with a retiring angle, becomes thickened, and unites with the inferior and posterior angle of the parietal bone. Lastly, it descends forward, thick and toothed, beneath the mastoid process, articulates with the upper portion of the lower edge of the occipital bone, and terminates at the petrous process near the stylo-mastoid hole.

183. *Structure.* The petrous process contains within it a very complicated organ, which we shall examine as we proceed. It is formed of a very dense and white compact tissue; next to the teeth, it is the hardest part of the skeleton; and from this circumstance it has derived its name. The mastoid process is filled with large cells. The rest of the bone presents the same structure as the other bones of the cranium.

184. *Articulations.* The temporal bone is articulated to the sphenoid, occipital and parietal bones, the malar bone, and the lower jaw, by the various points mentioned above.

185 *Development.* Its development takes place by six points of ossification, one for the petrous process, one for the contour of

the external auditory canal, one for the squamous portion, one for the mastoid process, one for the zygomatic, and one for the styloid process. The fourth and sixth make their appearance long after the rest. In certain cases, there are two osseous nuclei for the squamous portion.

OF THE PARIETAL BONE.*

186. *Form.* The *Parietal Bone, (Os Parietale: os Bregmatis:)* like the temporal, is double and unsymmetrical. It is of an irregularly quadrilateral form, concave internally, convex externally, and occupies the lateral upper and middle parts of the cranium. It presents the following parts.

187. An *Outer Surface*, convex, smooth, and covered by the epicranial aponeurosis in its upper half, somewhat uneven in its lower half, where the temporal muscle is inserted, and where there are sometimes observed slight furrows for the deep-seated temporal arteries. This surface is perforated, above and behind, by the *parietal foramen*, which varies much as to its size and position, and is sometimes even wanting. It gives passage to small vessels which establish a communication between those of the dura mater and pericranium. It has been seen on the occipital bone, and sometimes loses itself in the diploe, without passing through the bone. In the middle of this same surface there is observed an eminence, which is much more prominent in children than in adults, and is named the *Parietal Protuberance.* It surmounts a low curved ridge, which is continuous with the one observed on the frontal bone, and with the upper root of the zygomatic process, and which limits the temporal fossa. This ridge gives attachment to the temporal aponeurosis.

188. An *Inner* or *Cerebral Surface*, concave, invested by the dura mater, and marked over its whole extent with a great number of deep furrows which give lodgment to the divisions of the middle menyngeal artery, and which on account of their numerous ramifications obtained the name of the *fig-leaf* from the older anatomists. It also presents cerebral impressions; but they are rather indistinct, especially above. In the middle is a depression called the *Parietal fossa*, which corresponds to the protuberance of the same name. At the upper part, near the edge of the bone, there is observed a half groove running in a longitudinal direction, which is united to a similar half groove belonging to the other parietal bone, and is continued into the groove on the inner surface of the frontal bone. There are observed in it small irregular cavities, varying much in their number and arrangement, which receive the *granulations* of the superior longitudinal sinus of the dura mater.

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* From *paries*, a wall, because the sides of the head are principally formed of these bones.

189. *Four Edges*, of which the *upper* or *parietal* is the longest. It is straight and denticulate, and joins that of the opposite bone, with which it forms the sagittal suture. The *lower* or *temporal* edge is the shortest. It is concave, and surmounted by an oblique surface, marked with prominent radiating striæ, which is connected with the upper edge of the temporal bone, forming the squamous suture. The *anterior* or *coronal* edge is denticulate, and joins the frontal bone. The angle which it forms above with the upper edge is truncated in children, and substituted by a membranous part belonging to what is named the *Upper Fontanelle.* The angle formed below by its junction with the lower edge is much prolonged downwards and forwards. It is obliquely curved at its summit, and is articulated with the sphenoid bone. At its internal part, it presents a deep groove, or even a canal, which lodges the middle menyngeal artery, and from which proceed almost all the branches which constitute the *fig-leaf.* At the bottom of this groove, there frequently occur two small holes through which vessels pass into the diploe. Lastly, the *posterior* or *occipital* ~~angle~~ edge is extremely unequal. Its indentations are very irregularly disposed, and retain among them many of the small bones called ossa Wormii. They articulate with the upper edge of the ~~temporal~~ occipital bone. The angle which it forms below with the lower edge is truncated, and is articulated to the mastoid portion of the temporal bone. It is hollowed internally by a portion of a canal which is continuous with that existing on the occipital and temporal bones, and which lodges a part of the lateral sinus of the dura mater.

190. *Structure* and *Development.* The parietal bone is in general thin, although somewhat thickened at its upper and back parts. It consists of diploe contained between two compact plates. It is developed by a single point of ossification, which makes its appearance on the parietal protuberance, over a pretty wide extent, and under an areolar form.

191. *Articulations.* The parietal bone is articulated to that of the opposite side, and to the frontal, occipital, temporal and sphenoid bones.

OF THE OSSA WORMII.

192. The *Ossa Wormii* or *Triquetrous Bones* which are extremely variable as to size, situation, form, number, and other circumstances, are found interposed between the bones of the cranium which have been described.

Round heads scarcely ever present any of them, frequently none at all. In such as are elongated from before backwards, on the contrary, they occur in great numbers. It is in the suture formed by the occipital and parietal bones that they are most commonly met with. Sometimes the upper angle of the occipital bone is substituted by one of them.* They also pretty frequently occur between the two parietal bones, and especially at the union of their upper and anterior angle, where one is then seen which is of a quadrilateral form and of large size. The lower and anterior angle of these bones is also sometimes substituted by a triquetrous bone, which varies in size, and is frequently of an oval form. It is seldom that any are observed in the sutures between the temporal and parietal bones, and still more seldom in the base of the skull. We have, however, pointed out one as in many cases occupying the summit of the petrous portion of the temporal bone.

193. In general these bones are of the same thickness as the other bones of the cranium; but it may happen that they are merely formed in their outer or inner table.

194. They vary much as to extent, and are very irregular in their form. In general their two surfaces are smooth; their circumference is furnished with denticulations, by which they are connected with the other bones of the skull, or even with each other. Sometimes, however, they are so small as to rise in scales, and this is particularly the case when they occupy the inner surface of the sutures, as Hunauld has observed. Sometimes, on the contrary, they rise above the other bones, and form a prominence which might be taken for an exostosis.

Their structure and development are similar to those of the other bones of the skull; in other words, they are formed of two tables of compact substance, separated by a table of spongy substance or diploe.

b. OF THE SKULL IN GENERAL.

1. OF THE CONFORMATION OF THE SKULL.

Outer Surface of the Skull.

195. Viewed from without, the skull, in general, presents the form of a pretty regular ovoid, of which the small extremity is anterior, and commonly bears the same proportion to the large extremity in the adult as thirty to thirty-one. It is flattened on the sides in the region of the temples, and below towards its base. Over the rest of its extent it is convex. Its whole outer surface is pretty smooth at the upper part; but beneath it is uneven and perforated with a great number of holes. It is also observed that on the outside the skull is always more subjected to the laws of symmetry than on the inside.

196. It is more particularly on the outside that the mode of

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* This bone has been named the *Epactal* by some authors. It is only developed after birth, and is met with in one subject out of about fifteen or twenty.

junction of the bones of the cranium may be observed, where they form lines, more or less irregular, to which the name of *sutures* is given. These lines are in fact much less distinct on the inside of the skull, where they merely present the form of superficial marks without indentations, at least in adults. When they exist between bones of no great thickness, they penetrate directly into the skull; but when the contrary is the case, they follow an oblique direction, the edges of the bones being there shaped in such a manner as to overlap each other. All these sutures seem to proceed from various points of the circumference of the sphenoid bone.

197. Thus, from the anterior surface of that bone, there is seen proceeding to the right and to the left a curved line, concave anteriorly, which results internally from the junction of the sphenoid bone with the ethmoid and with the sphenoidal turbinated bones, and externally from the articulation of the first of these bones with the frontal. It traverses the upper wall of the orbit, and when it has arrived at the external orbital process of the frontal bone, it directs itself backwards, toward the anterior and inferior angle of the parietal bone. It then presents two more distinct dentations, and a greater thickness than in the rest of its extent, where the edges of the bones of which it is formed are extremely thin, and are merely placed together without interlocking by means of denticulations. This is the *Sphenoidal suture.*

198. Behind the sphenoid bone there is seen a second transverse short suture, which disappears with age, and is formed by that bone itself and the basilar process of the occipital bone. It is named the *Basilar suture.* So long as it exists, it is filled up by a cartilaginous plate lying between the bones.

199. On its lateral parts, the sphenoid bone is limited by a curved line, concave posteriorly, and arising from the junction of that bone with the squamous portion of the temporal. This is the *Spheno-temporal suture.* It presents denticulations, although the surfaces of which it is formed are cut very obliquely. It terminates below toward the glenoid fissure, by forming an acute angle with another suture named the *Petro-sphenoidal*, produced by the anterior edge of the petrous process and the posterior edge of the sphenoid bone; and it unites above with the sphenoidal suture by a short longitudinal line, slightly curved, which results from the junction of the extremity of the great wings of the sphenoid bone with the anterior and inferior angle of the parietal bone, and which may be named the *Spheno-parietal suture.*

200. From the anterior angle of the latter suture proceeds the *Fronto-parietal* or *Coronal suture*, which cuts the upper part of the cranium almost vertically, and terminates at the corresponding point of the other side. It points out the separation of the frontal and two parietal bones, and is so disposed that the former of these bones rests above each parietal bone which supports it below. It presents denticulations at its upper part, which however are not

very distinct, and it is but rare that triquetrous bones occur in it, which is also the case with the sutures already mentioned.

201. From the opposite angle there arises the *Squamous suture*, which describes about a third of the circumference of a circle, proceeding backwards and downwards. It separates the temporal bone from the lower edge of the parietal, and is formed by an overlapping of these bones, the latter sustaining the other, which frequently projects outwards. A little before it terminates, it changes its direction, forming an obtuse and retiring angle, and proceeds backwards to meet the occipital bone. The last mentioned part of the suture is not squamous. It results from the junction of the posterior and inferior angle of the parietal bone with the mastoid portion of the temporal. It is always formed by very irregular and very distinct indentations, and almost always contains supernumerary bones, which are not often met with in the squamous portion properly so called.

202. From each extremity of the basilar suture there is seen arising a line which separates the petrous process of the temporal bone, and the sides of the basilar process of the occipital, and afterwards the latter bone from the temporal. From being at first concave, and directed outwards and forwards, this line becomes afterwards straight, and proceeds directly backwards when it has arrived at the middle part of each condyle of the occipital bone. The first part of this line is named the *Petro-Occipital Suture*, while the name of *Mastoidal Suture* is applied to the second portion, which slightly rises to meet the extremity of the squamous suture, and which in general presents neither distinct indentations nor supernumerary bones.

The petro-occipital suture is a true groove, deep and pretty wide, in which the bones are not in immediate contact, but present an intervening thin layer of cartilage.

203. From the angle formed by the union of the mastoidal and squamous sutures, there arises another suture, with very distinct denticulations, which separates the occipital from the parietal bones, and which is named the *Lambdoid* or *Occipito-Parietal* suture. It ends at the corresponding point of the opposite side, and gives rise, in its middle part, to an acute angle projecting forwards so as to form the two sides of a triangle having its base directed downwards. In general there are numerous triquetrous bones in this suture; and of all the sutures of the skull, this has its denticulations most distinctly marked.

204. Another longitudinal suture, which separates the two parietal bones, and is named the *Sagittal*, arises from the angle formed by the last described. It presents distinct indentations, and is sometimes traversed posteriorly by the parietal hole. It falls upon the middle of the coronal suture, and is then continued, pretty frequently in adults, and always in children, into another longitudinal suture, which divides the frontal bone into two equal parts.

A large wormian bone of a quadrilateral form frequently occupies the place of this union.

205. The last-mentioned suture, which is frequently designated by the name of the *Median* or *Frontal*, and which is generally indistinct, and occurs much more frequently in children than in adults, ends at the nasal spine of the frontal bone, where it is continued on each side into a line formed by the ethmoidal notch of that bone as it joins the ethmoid, and which afterwards terminates at a right angle in the sphenoidal suture, under the name of *Ethmoidal Suture*. It is in it that the internal orbitary foramina occur.

206. The sutures which, as we have said, are formed by the mutual connection of the bones of the skull, are not so fixed and determinate as not to present considerable variations. It is not the case, however, that their number is greater in females than in males, as has been asserted by some of the older anatomists. In certain individuals, they are partly effaced; and skulls have even been alleged to have been seen, in which there were no sutures at all, of which Bartholin* mentions several examples. Some years ago, I presented to the medical faculty of Paris a skull in which the frontal suture was obliterated on one side. The triquetrous bones are sometimes so numerous in the lambdoid suture, as to produce the appearance of a double suture in that place. Vesalius and Eustachius saw the sagittal suture separating the occipital bone into two portions; and Ruysch observed a subject in which it extended over the occipital and frontal bones. Van Swieten† had a skull in which the same suture was an inch broad at the top of the head, and contracted before and behind.

207. The outer surface of the skull is divided into four regions, as follows:

208. *Upper Region.* This region is of an oval form, and is limited anteriorly by the nasal protuberance, posteriorly by the outer occipital protuberance, and laterally by a curved line which extends over the coronal and parietal bones. There is observed upon it, anteriorly and in the middle line, the suture which unites the two pieces of the frontal bone, or merely the remains of this suture. On the sides of the latter, are the frontal protuberances, which surmount the superciliary arches, and which are situated beneath the fronto-parietal suture. In the middle part of the latter is seen the termination of the sagittal suture, on the lateral parts, on which are observed the parietal holes behind, and more to the outside a broad smooth surface, from which rises the parietal protuberance. This suture terminates at the angle formed by the union of the two branches of the lambdoid suture, which proceeds downwards and backwards toward the temporal bone, and presents in the interval above, a

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* *Anatome quartum renovata*, p. 701. *Lugduni*. 1677.

† *Comment*. T. I. p. 377.

slight depression corresponding to the upper angle of the occipital bone, and below, the external protuberance of that bone. This region of the skull is almost entirely covered by the occipital and frontal muscles, and by the tendinous expansion by which they are united. It is in general smooth and even, and presents no other apertures than the parietal holes.

209. *Inferior Region.* This region is free in its posterior half. In the anterior, it is articulated with the bones of the face. It extends longitudinally backwards from the nasal notch to the external occipital protuberance, and is limited on the sides by an irregular undulated line, which proceeds from that eminence to the mastoid process, from thence directing itself between the glenoid cavity and the meatus auditorius, toward the base of the Zygomatic process, to be continued into the ridge, which separates the temporal region of the sphenoid bone into two parts, and to terminate at the external orbitary process. The objects comprehended in this region, which does not present any convexity similar to those which the vault forms behind, are very numerous.

210. From the occipital protuberance, there proceeds, on either side, the upper curved line, and downwards the external occipital crest, from the middle of which the lower curved lines seem to arise. Between the latter and the upper, are observed impressions into which are inserted the complexus magnus and splenius. Anteriorly to the external occipital crest, is the occipital hole, on the lateral and posterior parts of which are the marks of the insertions of the small and great posterior recti and superior oblique muscles of the head, and which presents anteriorly the occipital condyles with the attachments of the odontoid ligaments, the posterior and anterior condyloid fossæ, and their corresponding holes. To the outside of the condyles, there are observed the insertions of the recti capitis laterales, the jugular process of the occipital bone, the mastoidal suture, the groove of the same name into which is inserted the digastric muscle, the foramen stylo-mastoideum, and a small aperture for the passage of the nervous filament called the chorda tympani.

211. Beyond the occipital hole is the basilar surface, with inequalities for the rectus capitis anterior major and minor, which arise from them. It is limited anteriorly by the basilar suture. On each of its sides it presents the petro-occipital suture, terminated behind by a pretty deep cavity, commonly more distinct on the right side, rarely wider on the left, and sometimes of equal size on both sides. This is the *Jugular Fossa*, which is formed by the petrous portion of the temporal bone and the occipital bone, and which lodges the commencement of the jugular vein. It is also in the bottom of this fossa that the *Foramen lacerum posterius* is observed, which communicates with the cavity of the skull, and whose margin is very unequal. A small bony plate, frequently completed by a cartilage, rising from the occipital or temporal bone, divides it into two parts, of which the anterior is smaller than the

posterior. The former gives passage to the glosso-pharyngeal, pneumo-gastric, and spinal accessary nerves, as well as to some vessels. The latter is traversed by the internal jugular vein. The anterior extremity of the petro-occipital suture opens into the *Foramen lacerum anterius*, the margin of which is still more irregular than those of the posterior, and which is formed by the meeting of the sphenoid and occipital bones, and the petrous portion of the temporal. It is entirely closed by a cartilaginous substance in the recent state, and does not give passage to any organ.

212. On the outside of the petro-occipital suture, there is observed an uneven surface belonging to the petrous process of the temporal bone, and giving insertion to the internal peristaphyline muscle and tensor tympani of the malleus; the lower orifice of the carotid canal; the styloid and vaginal processes; the petro-sphenoidal suture, which seems continuous with the glenoid fissure, and which presents at its outer extremity the orifices of the bony portion of the Eustachian tube, and of the canal of the inner muscle of the malleus; the sphenoidal spine; the two portions of the glenoid cavity of the temporal bone, in one of which there is frequently noticed a small canal for the chorda tympani; the transverse root of the zygomatic process; the spheno-temporal suture; and lastly, the foramen spheno-spinosum and foramen maxillare inferius.

213. Anteriorly to the basilar suture, there is seen the sphenoidal crest which enters into the upper edge of the vomer. On the sides of the latter are two small grooves which receive the lips of this edge, and which are often perforated at their bottom, but only in young subjects, by the lower orifice of a narrow canal which occurs in the outer wall of the sphenoidal sinuses. There are also seen in it two narrow and not very deep channels, which concur to form the pterygo-palatine canals. Still more outwards, we find the pterygoid process; the posterior orifice of the vidian canal, which occupies its base; the scaphoid depression situated on the upper and outer part of the inner wing of the pterygoid process, perforated by vascular apertures which terminate on the other hand on the sides of the super-sphenoidal fossa, and giving attachment to the external peristaphyline muscle; the pterygoid fossa, into which is inserted the pterygoideus internus; the bifurcation which receives the tuberosity of the palate bone; and the hook over which is reflected the tendon of the peristaphylinus externus.

214. Before the pterygoid process, which descends vertically, and which forms the most prominent part of this region of the skull, is observed the anterior orifice of the vidian canal, which is wider than the posterior. Beside it, and a little to the outside, is the external orifice of the foramen rotundum; and, anteriorly and inwards, the entrance of the sphenoidal sinuses and the junction of the sphenoid bone with the sphenoidal turbinated bones and the ethmoid bone. The perpendicular plate of the latter bone is situated between the orifice of the sinuses, and presents, on either side, two deep and narrow channels which form part of the nasal fossæ, and

at the bottom of which are found the olfactory foramina, and the small slit which gives passage to the internal nasal nerve. Anteriorly, is the point of contact of this plate with the nasal spine of the frontal bone, and the nasal notch of the same bone, which is continuous laterally with the orbitary arches, interrupted by the superciliary hole, which is generally but a superficial notch, and which is sometimes double. These arches terminate at the union of the frontal with the malar bone.

215. Between them and the pterygoid processes, are the two orbitar vaults of the frontal bone, concave, triangular surfaces, having their base forwards, and in which there are seen, posteriorly, the sphenoidal fissure, the foramen opticum, the lower surface of the process of Ingrassias, the sphenoidal suture, the external orbitar holes, consisting of small apertures most commonly formed in a portion of the great wing of the sphenoid bone, and the internal orbitar holes, which are directed obliquely from below upwards, and from behind forwards; on the outside and anteriorly, the small fossa of the lachrymal gland; and on the inside, the attachment of the pulley of the obliquus major muscle of the eye. Externally the cavity of the orbit is limited by an uneven line, where the frontal and sphenoid bones unite with the cheek bone, and on the inside by the lateral masses of the ethmoid bone, which form a considerable projection on each side of the median line, and at the lower part of which are seen the ethmoidal turbinated bone, a portion of the middle meatus of the nasal fossæ, the infundibulum, and some papyraceous laminæ which articulate with the upper maxillary bone, while above, by uniting with the frontal bone, they form the ethmoidal suture.

216. It is observed that most of the eminences of the free portion of the lower surface of the skull, such as the mastoid, jugular, styloid, vaginal, and pterygoid processes, are intended for the insertion of parts.

217. *Lateral Regions.* Each of the lateral regions is of an irregular elliptical form, and extends horizontally from the external orbitar process to the lambdoidal suture, and vertically from the elevated curved line on the parietal bone to the base of the zygomatic process. They are divided into two portions.

218. Of these, the *upper*, which is of great extent, has received the name of *Temporal Fossa*, although it merits this appellation only at its fore parts, where it is concave, for behind it is plane and even convex. It is filled by the temporal muscle, and is formed by the temporal and sphenoid bones below, and by the parietal and frontal above. It is traversed by various sutures, the fronto-*parietal* or coronal, the sphenoidal, the spheno-temporal, the spheno-parietal, and the temporo-parietal or squamous, a small portion only of the two first appearing upon it. It also presents a considerable number of furrows for the deep-seated temporal arteries.

219. This temporal fossa, at the lower part of which is seen the

zygomatic process, is circumscribed by a low ridge, which gives attachment in the greater part of its extent to the aponeurosis of the temporal muscle. This line, which commences at the external orbitar process, ascends backwards upon the frontal bone, and then descends on the parietal, to proceed forwards over the temporal bone to the base of the zygomatic process, and to be continued horizontally, on the one hand, into that apophysis, and on the other, into a prominence which extends over the sphenoid bone to its union with the cheek bone.

220. The other portion of the lateral regions of the skull, which is the *posterior* and smaller, presents at its back part the mastoid process, surmounted by the mastoid hole, and limited before by the meatus auditorius externus. It is limited behind by the mastoidal suture.

Inner Surface of the Skull.

221. This surface forms the boundary of a large cavity, of an oval form, with the small extremity turned forwards. Its transverse diameter is somewhat greater than the perpendicular. In general, it is symmetrical, unless in some rather rare cases, in which, without the existence of any morbid cause, one side is larger than the other, of which we have seen a very remarkable example in the skull of the celebrated Bichat. This cavity is continued behind and below into the vertebral canal, and comprehends two very distinct regions, the *vault* and the *base*, which are both lined by the dura mater. The surface of the bones which constitute them is very smooth, brittle and thin, and is named by most anatomists the *Vitreous Table*.

222. The *Vault of the Skull*, which is rounded and pretty regularly curved, is separated from the base by a circular line carried from the root of the nose to the occipital protuberance. Over its whole extent there are observed cerebral impressions and arterial furrows. A channel, narrower before than behind, passes over it in a longitudinal direction, from the frontal crest which is observed at the fore part, and which has frequently a small groove formed along its whole extent for the attachment of the falx cerebri, to the internal occipital protuberance, where it terminates posteriorly. This channel, which lodges the superior longitudinal sinus of the dura mater, presents in its middle part the sagittal suture, the serratures of which are much less distinct than on the outer surface of the skull, as is indeed the case with all the sutures. On its sides it presents many small irregular cavities, which lodge the granulations of the membranes of the brain, and the internal orifices of the parietal holes, when they exist. We also observe in the vault of the skull laterally, the coronal fossæ, the fronto-parietal suture, and the parietal fossæ, separated from the superior occipital by the lambdoid suture, and formed opposite the protuberances of the same name.

223. The *Base of the Skull*, which is flat and very uneven, is

formed by three planes placed successively the one above the other from the posterior to the anterior part, and representing by their union a sort of inclined surface, much lowered behind and extremely uneven. The upper edges of the processes of Ingrassias and the upper edges of the petrous processes constitute the respective limits of these three planes, and allow each of them to be examined separately.

224. The *first plane* presents, immediately before and in the middle line, the foramen cœcum or spinale. This hole which exists at the lower part of the frontal crest, is narrow, not very deep, and appears to have but doubtful communications with the outside. Bertin* says he has frequently seen its bottom perforated by another ~~long~~ osseous canal which penetrated into the anterior cells of the ethmoidal notch of the frontal bone, and I have made the same observation; which would seem to demonstrate that this hole penetrates into the cavity of the nostrils. Petit, of the Academie des Sciences, asserts that it gives passage to a small vein, which comes from the nose into the superior longitudinal sinus of the dura mater. This much is certain, that a bristle or stylet cannot be passed through it, and that it is frequently formed at the expense of the frontal and ethmoid bones.

225. Behind the fronto-ethmoidal or spinous hole, are observed the mark of the union of the frontal and ethmoid bones, the process of the crista-galli, the olfactory grooves with the holes and fissure which they present, a suture which limits them posteriorly, which results from the junction of the sphenoid with the ethmoid bone, is continued laterally into that formed by the frontal bone and the apophyses of Ingrassias, and is intersected at right angles by two other sutures formed by the junction of the ethmoid bone with the frontal, and presenting in their course two or three apertures, which are the cranial orifices of the internal orbitar foramina.

226. This first plane, which is limited posteriorly by the surface on which the olfactory nerves rest, and by the transverse channel which corresponds to the junction of the optic nerves, presents in the same direction the two optic holes and the anterior clinoid processes, which are continuous with the posterior edge of the small wings of the sphenoid bone. Anteriorly to this edge is a convex uneven surface, presenting numerous cerebral impressions, formed by the frontal bone and the sphenoid, and supporting on each side the anterior lobe of the brain.

227. The *second plane* is occupied in its centre by the pituitary fossa, in which several small apertures are remarked. This fossa, which corresponds to the sphenoidal sinuses, presents posteriorly a square plate, the angles of which form the posterior clinoid processes, and on its sides, the cavernous sinuses, together with the cranial orifices of the two small canals formed in the outer wall of the sphenoidal sinuses.

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* Loc. cit. vol. i. p. 97.

228. Laterally, there is observed to the right and left, a large fossa, wide externally, narrow within, of the form of a curvilinear triangle, extended from the sphenoidal fissure to the upper edge of the petrous process. In this fossa are remarked the spheno-temporal, squamous, spheno-parietal and petro-sphenoidal sutures, together with the sphenoidal fissure, the superior and inferior maxillary holes, the spheno-spinous hole, and the hiatus of Fallopius. There are also observed in it several pretty distinct mamillary eminences, the anterior lacerated hole, in the margin of which is the opening of the carotid canal, and which pretty frequently even seems to be distinguished from it by a small projecting lamina of the sphenoid bond, two arterial furrows, which arise from the spheno-spinous hole, and of which the largest, forming occasionally a canal at its commencement, goes to the lower and anterior angle of the parietal bone; the channel which lodges the superior petrous sinus; the depression corresponding to the trunk of the trifacial nerve; and, lastly, an indistinct hole, sometimes wanting in adult age, frequently occurring only on one side, and situated between the two maxillary holes of the sphenoid bone. It gives passage to an emissary vein of Santorini, and has been particularly pointed out by Vesalius, on which account it is named by some anatomists the Foramen Vesalii.

229. The *third plane* is perforated in its middle part by the occipital hole, whose orifice is wider here than on the outside of the skull. Before it are observed the basilar channel, formed by the occipital and sphenoid bones, and the basilar suture, which separates it transversely into two portions. This channel has on its sides two longitudinal depressions which lodge the inferior petrous sinuses. It corresponds to the annular protuberance of the brain and the transverse sinuses of the dura mater. It is terminated above by the quadrilateral plane which limits the pituitary fossa, and presents, before terminating, and on each side, a small notch for the passage of the external motory nerve of the eye. Behind the occipital hole is the internal occipital ridge, bifurcated at its lower part. On its sides, are observed the anterior condyloid foramina, the inner orifice of which is less raised than the outer, and which are perforated in their course by several small canals which transmit vessels to the diploe of the occipital bone, and surmounted by a low bony arch; and two very deep fossæ, formed by a large portion of the sphenoid bone, the posterior surface of the petrous process, and the posterior and inferior angle of the parietal bone. In the bottom of these fossæ, is seen the mark of the mastoideal and petro-occipital sutures, which would be continued in the same direction, were they not separated on each side by the foramen lacerum posterius. This hole is smaller on the inside of the skull than on the outside, and presents at its upper part the triangular orifice of the aqueduct of the cochlea, which is closed by the dura mater in the recent state. It is pretty frequently observed, that on the right side the posterior lacerated hole is much larger than on the left. The reverse also

takes place, although rarely; and sometimes their diameters are equal.

230. A channel which lodges the lateral sinus of the dura mater arises from the foramen lacerum posterius behind, and proceeds to the inner occipital protuberance. Descending slightly at first, it mounts behind the base of the petrous process, and then proceeds in a horizontal direction to the point where it terminates. It is formed above by the occipital and parietal bones, in the middle by the temporal, and below by the occipital again. The posterior condyloid foramen, which presents many variations as to number, size, and direction, opens upon it near the jugular fossa, and the mastoid hole perforates it behind the petrous process. The latter hole is frequently nothing but the orifice of a canal which passes in a very oblique manner through the substance of the temporal bone, and is wider on the inside of the skull than on the outside. It is also frequently more distinct on the one side than on the other, or is even entirely wanting; nor is it rare to find it in the lambdoid suture.

The channel of which we speak is commonly larger on the right side, which is the cause of the variations which we have pointed out in the size of the posterior lacerated holes. It circumscribes the lower occipital fossæ, which receive the hemispheres of the cerebellum, and is surmounted at its origin by the internal auditory canal and the orifice of the aqueduct of the vestibule.*

231. It is only in man that the direction of the occipital hole is horizontal, and that it is situated nearly in the middle of the base of the skull. In all other animals, it is oblique, and situated behind. Sometimes it is even vertical. We shall presently see what influence this circumstance has upon the position of the centre of gravity of the head, and upon the general attitude.

2.—DIMENSIONS OF THE SKULL.

232. The slightest inspection of a skull that has been sawn horizontally is sufficient to show that the part of it which has received the greatest development is situated at the level of the occipital hole and basilar groove, the place where the brain, the cerebellum, and the medulla elongata unite. But if it be desired to determine the dimensions of this cavity in a rigorous manner, the measurements must not be made on the external surface, because very frequently it does not correspond with the internal, either in form or extent, on account of the variations that occur in the development of the different sinuses existing on the bones, as well as in the

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* Most anatomists divide each of the planes above described into three, which makes the number of fossæ in the base of the skull nine, three middle and six lateral, or rather three anterior, three middle, and three posterior. The suprasphenoidal fossa is the one which in all cases occupies the centre.

thickness of the bones themselves, which is sometimes such that a person whose head appears very large may yet have a small brain. Facts like these are well adapted to fortify the young anatomist against the enthusiasm which might be inspired by systems purely hypothetical.

It is by measuring in the inside of the skull only that we can determine its diameters, of which there are three more important than the others.

The first or *longitudinal* diameter extends from the foramen cœcum to the internal occipital protuberance. It is the largest, and measures about five inches.

The second or *transverse* diameter passes from the base of one petrous process to that of the other. It is about four inches and a half.

The third or *vertical* diameter, which is comprised between the anterior extremity of the occipital hole and the middle of the sagittal suture, is a few lines less than the transverse.

These diameters must be measured in adult heads, and from the points mentioned, for the lines that are drawn parallel to them diminish in length in proportion as they recede from them, in whatever direction.

233. The dimensions of the skull, which are always much greater than those of the face, vary considerably in different individuals, and we only give them here as something about the medium; for each of the three diameters may predominate over the others, always, however, by gaining at their expense, which gives rise to many varieties in the form of different heads, although the general capacity of the cavity remains always pretty much the same. Thus we see *broad heads*, flattened before and behind; *high heads*, in the form of a sugar loaf; *long heads*, compressed laterally; according as the transverse, vertical or longitudinal diameter is largest. The seat of these differences is always in the arch of the skull, for the base remains constantly the same.

234. The different regions of the skull vary with respect to their thickness, which is pretty uniform over the vault, of which, however, the upper part is one of the places in which it is most distinct, and is much diminished in the temporal and orbital regions, as well as in the lower part of the occiput. The base of the skull, which is very thick at the place of the petrous process, the body of the sphenoid bone, the basilar process, and the ridges and protuberances of the occipital bone, is generally very thin in the cerebellar fossæ, the bottom of the grooves of the cribriform plate, the part which corresponds to the orbits, in all which places there is observed very little spongy tissue.

The skull is commonly thinner in children and young people than in adults and aged persons, in whom it generally becomes thicker and more spongy, although it also frequently becomes thinner, either over its whole extent, or only in certain parts. It would also appear that it is harder and thicker in persons affected with mania. In the collection of the Faculty of Paris there is a skull of enormous thickness. In 1742, Morand presented one to the French Academy, the walls of which were nine lines thick, without any diploe, and uniformly compact. Thomas Bartholin[*] mentions one of which the walls were also formed of a single layer. M. Jadelot some years ago described a very thick and solidified skull, in which all the holes which commonly give passage to nerves were obliterated. Various authors[†] also mention that excrescences resembling horns of greater or less size, sometimes rise from the surface of the skull.

3.—USES OF THE SKULL.

235. The uses of the skull are numerous and varied. We have already pointed them out in describing that cavity. It will, therefore, be sufficient here to say in a general manner, that the skull lodges the brain and most of its dependences; that it guards them against external injuries, and sustains all their parts, whether by itself or by the points of attachment which it furnishes to the menynx; that it serves for the articulation of the head with the trunk properly so called; affords a fulcrum for the motions which the lower jaw performs on the upper; transmits externally nerves and vessels; allows others to enter into its interior; gives attachment to a great number of muscles; contains the organs of hearing, &c.

II.—OF THE FACE.

236. The *Face* is all that part of the head which is situated before and under the skull. It is limited above by that cavity, laterally by the zygomatic arches, behind by an empty space, in which is lodged the upper part of the pharynx. Its form is symmetrical, its direction vertical, its figure triangular, and its structure very complex. We have already taken occasion to point out its principal divisions, and to mention the names of the bones which enter into its composition. These bones are much more numerous than those of the cranium.

A.—OF THE BONES WHICH COMPOSE THE UPPER JAW.

OF THE SUPERIOR MAXILLARY BONE.

237. *Form.* The *Superior Maxillary Bones* are to the face what the sphenoid bone is to the skull: they articulate with all the pieces of which it is composed, determine its figure almost of them-

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[*] Anatome, p. 700.

[†] Ambrose Pare, Fabricius of Hilden, Severino, Th. Bartholin, &c.

selves, and assure its solidity. Their size is large, their form very unequal. They occupy the middle and anterior part of the upper jaw, and their uses are very extensive. They enter into the composition of the orbit, nasal fossæ, and mouth, give passage to various nerves and vessels, and afford insertion to numerous muscles, &c. We shall distinguish in these bones two surfaces, and a circumference.

238. *Outer* or *Orbito-facial Surface*. The whole of this surface may be seen, without separating the bone from those in its vicinity. It is surmounted at the inside by an eminence laterally flattened, which rises above all the other parts of the bone; the *nasal process*, which is smooth and concave from above downwards externally, where it presents several holes through which the vessels which nourish the bone pass, and where it furnishes points of insertion for the levator labii superioris and the levator communis labii superioris alæque nasi. To the inside, this process forms part of the outer wall of the nasal fossæ. There are observed at its upper part irregularities which are connected with the lateral masses of the ethmoid bone, beneath which is a channel belonging to the middle meatus of the nostrils, and farther down, a horizontal crest, united to the inferior turbinated bone. Arterial furrows also traverse this region of the process, which terminates above in a truncated summit, furnished with denticulations, and articulated to the nasal notch of the frontal bone; below, in a thin oblique edge, which rests upon the nasal bones; behind, in a channel narrower and less deep above than below, articulating with the lachrymal bone by its posterior lip, which is more prominent than the anterior, and by the latter, which is free, giving attachment to the tendon and some fibres of the orbicularis palpebrarum muscle. This channel forms part of the lachrymal groove.

239. To the outside of the nasal process, and behind it, is a smooth triangular surface, inclined downwards, forwards, and outwards, and forming part of the floor of the orbit. Toward the middle and outer region, it presents a channel which soon changes into a canal, named the *infra orbitar*, which lodges the vessels and nerves of the same name, and divides anteriorly and inwards, in which direction it runs into two subordinate canals. Of those canals, the posterior, which is smaller, descends, under the name of the *superior and anterior dentary canal*, in the anterior wall of the maxillary sinus, where it sometimes opens. It affords a passage to nerves and vessels which bear the same name. The other, or anterior division, which is wider and shorter, follows the original direction of the canal, and ends at the infra-orbitar hole.

240. This surface, which gives attachment on the inside and before to the small oblique muscle of the eye, is limited behind by a rounded edge, which concurs to form the spheno-maxillary fissure; internally, by another thin and uneven edge, which is notched before and behind, to be articulated with the lachrymal and palate bones, and which is connected with the ethmoid; anteriorly,

by a third edge, which is rounded, of small extent, forming part of the contour of the orbit, and giving attachment to some fibres of the levator labii superioris. Between this edge and the posterior, is observed a triangular and very rough eminence, named the *malar* or *zygomatic process*, which is articulated to the cheek-bone.

241. From the outer angle of this process, there descends vertically a blunt prominent edge, concave from above downwards, behind which is a portion of the bone belonging to the zygomatic fossa, while before it is a pretty distinct depression, called the *infra-orbitar fossa* or *fossa canina*, perforated above by the infra-orbitar hole, which gives passage to the infra-orbitar vessels and nerves, and affording attachment below to the canine muscle. Anteriorly, this fossa is bounded by the *myrtiform fossa*, an indistinct depression, into which is inserted the depressor of the wing of the nose.

242. *Inner* or *Naso-palatal Surface.* This surface can only be well seen when the bones have been separated. Above, where it is invested by the pituitary membrane, it is concealed in the nasal fossæ; while below, where it is lined by the palatine membrane, it forms part of the arch of the palate. It is divided into two portions of different extent, by a broad flat horizontal eminence, very thick before, which is named the *palatal process.* This process corresponds below to the mouth, and above to the nose. In the latter direction, where it presents at its fore-part one of the superior apertures of the anterior palatal canal, it is transversely concave, smooth, and polished. In the former direction, on the contrary, it is rough, uneven, and marked with several furrows, which are sometimes converted posteriorly into small bony arches, more or less complete, under which the palatine nerves and vessels pass. Posteriorly, it is bounded by a slope which sustains the palatal bones; internally, it unites with the opposite bone by a thick striated edge, presenting anteriorly a channel which occupies only the lower half of its thickness, and is directed obliquely forwards. By uniting with a similar channel in the other bone, it forms the *anterior palatal canal.* This edge is also surmounted by a ridge, deflected a little outwards, more prominent before than behind, and which constitutes the half of a groove, into which the vomer is received.

243. Beneath the palatal process, there is observed a concave surface of small extent, uneven, and covered with furrows. Above it, on the contrary, is seen a broad vertical surface, in the middle of which is a large and very irregular opening, with thin and ragged edges. This opening conducts to a large cavity formed in the substance of the bone, and which is named the *maxillary sinus* or *antrum Highmorianum.* This sinus, which is the largest of those of the head, and which is sometimes divided by septa, has nearly the form of a triangular pyramid, with the base turned inwards. It corresponds above to the floor of the orbit, and contains in its upper wall the infra-orbitar canal; before, to the canine fossa, and the upper and anterior dentary canal, which frequently forms a re-

markable prominence in its interior; behind, where it presents the mark of the posterior dentary canals to the maxillary tuberosity; below, by a surface less broad than in the other directions, to the alveoli of the molar, and sometimes of the canine teeth. The roots of these teeth pretty frequently raise up the thin bony plate which forms the floor of the sinus, and have even been seen to perforate it. Entirely to the outside, the summit of this cavity is seen formed in the malar process, and the bony plate, by which it is separated from the cheek-bone, is so thin as to be frequently broken when that bone is separated. The orifice of the sinus, which is sometimes double, is articulated above with the ethmoid bone; below and before with the inferior turbinated bone; behind with the palate bone; and these bones contract it in a singular degree. This cavity is lined by a prolongation of the pituitary membrane.

244. At the lower part of the aperture of the sinus, there occurs an oblique slit directed forwards and outwards, of which the posterior lip is inclined into the sinus, and the anterior toward the nasal fossæ, and which receives a plate of the palate bone. At the upper part of the same aperture, there are seen portions of cells which unite with those of the ethmoid bone. Before it is a deep channel, narrower at the middle than at its extremities, directed obliquely downwards, backwards and inwards, slightly convex before and outwards, continuous with the lachrymal groove, and forming the greater part, sometimes even the whole of the *Nasal Canal.* Behind the orifice of the sinus, there are observed an uneven surface, which is united to the palate bone, and a superficial channel which proceeds downwards and forwards, and contributes to form the *Posterior Palatal Canal.*

245. *Circumference.* At the back part, the two surfaces of the upper maxillary bone are separated by an unequal eminence, which is called the *Maxillary Tuberosity.* It is much more prominent in young subjects than in old people, because it contains the last molar tooth, and diminishes considerably after its protrusion. It is perforated by the *Posterior Dentary Canals,* which open externally in the form of two or three small holes, and which, as well as the anterior, disappear as they approach the alveoli, and leave the nerves and vessels to descend from one cellule to another, in the diploe of the bone.

246. Anteriorly, between the two surfaces of the bone, there is observed a free edge deeply concave at its upper part, which forms a portion of the anterior aperture of the nasal fossæ. At its lower part it is prominent, and articulates with the bone of the opposite side, and in its middle presents an eminence which forms the half of the *Anterior Nasal Spine.* This edge unites above with that which terminates anteriorly the nasal process of the frontal bone, forming a more or less projecting angle with it.

247. Lastly, at the lower part, the two surfaces of the bone are separated from each other by the *Upper Alveolar Edge* or *Alveolar Process.* This edge is thick, less so however before than behind,

where the Buccinator muscle is inserted. It describes in its course a portion of a parabola, and is marked with deep conical cavities, which receive the teeth, and which are named *Alveoli* or *Sockets.* The form and dimensions of these alveoli vary according to the kind of teeth which they lodge; and when the teeth have several roots, they are divided into a similar number of subordinate cavities by particular septa. The alveolus of the first incisor is deeper and broader than that of the second, but much less so than that of the canine tooth, which is compressed, and ends in a very sharp cone. Two of the small molares are not so deep. The most variable is the last, which is commonly divided into three cavities, sometimes into two, and in some cases presents only one. Each maxillary bone has generally eight of these alveoli, the partitions of which are formed of a cellular tissue, which is examined posteriorly, are found to be less and less compact. Externally, the edge in which they are formed presents corresponding prominences and depressions. On the inside, it is perforated with a great number of small holes which transmit vessels to the walls of the alveolar cavities.

248. *Structure.* In general, the upper maxillary bone is thick and cellular, especially toward its different processes, and in the alveolar margin. It is hollow, and as it were inflated in nearly its whole extent, on account of the presence of the sinus which is formed in its interior.

249. *Articulations.* The upper maxillary bone is articulated to the ethmoid, the frontal bone, the nasal bone, the lachrymal bone, the palate bone, the inferior turbinated bone, the vomer, the opposite maxillary bone, the teeth of the upper jaw, and sometimes the sphenoid bone, by the different points mentioned above.

250. *Development.* The development of this bone takes place in a very complicated manner. At first there appear some osseous nuclei, which commence the formation of the upper alveolar arch. Then the body of the bone is formed by one or two points of ossification; and in the latter case, there occurs in the fetus a small distinct osseous piece, which seems analogous to the inter-maxillary bone of quadrupeds. The sinus is only developed with age, and sometimes is not formed at all, of which Morgagni mentions an example.* The palatal process also arises from a separate germ, which forms the inner wall of the alveoli, excepting those of the incisors. The zygomatic and orbitar processes are also each produced by a separate point. In many cases also an isolated small bone forms the upper part of the nasal canal.†

OF THE PALATE BONE.

251. *Form.* The *Palate Bone, (Ossa Palati,)* which is of a very

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* *Adv. Anat.* p. 38. *Adv.* vi. p. 116.

† BECLARD, *Nouveau Journal de Medicine,* April, 1819, p. 332.

irregular figure, and was long confounded by anatomists with the upper maxillary bone, is situated behind the latter, and below the middle region of the base of the skull. It seems formed by the union of two plates joined at a right angle, so that one of them is horizontal and inferior, the other vertical and superior. Each of these portions is commonly described separately in order to facilitate the examination of this bone, which is very complicated.

252. *Horizontal* or *Palatal Portion.* It is quadrilateral, and seems to be the continuation of the palatal process of the upper maxillary bone. Its *Upper Surface* is smooth, and forms part of the floor of the nasal fossæ. It is concave from within outwards, and straight in the other direction. The *Lower Surface*, which is wrinkled and uneven, although less so than the corresponding surface of the maxillary bone, presents posteriorly a transverse ridge for the insertion of the peristaphylinus externus, and forms part of the arch of the palate. There is also observed upon it, in the same direction, and a little outwards, an oval hole, sometimes double, which is the inferior orifice of the posterior palatal canal. Anteriorly, this portion of the bone rests upon the palatal process of the upper maxillary bone, by means of an oblique edge. Posteriorly, it is terminated by a second edge, named the *Guttural*, which is free, sharp, and notched, and gives attachment to the velum palati. At its inside it is furnished with an eminence, which, on being united with that of the opposite side, forms the *Posterior Nasal Spine.* To the inside, it presents an uneven edge, much thicker than the others, articulated to the corresponding bone, and surmounted by a thin crest, which contributes to the formation of a groove into which the vomer is received. Externally, it is confounded with the vertical portion. The centre of the horizontal portion of the palate bone is much thinner than its edges.

253. *Vertical* or *Ascending Portion.* This portion is of an oblong form, slightly inclined inwards, broader and thinner than the horizontal, and rests upon the upper maxillary bone. Its *Inner Surface*, which enters into the composition of the nasal fossæ, presents below a broad and superficial depression, which belongs to their inferior meatus, and which is separated from another depression situated above, and forming part of the middle meatus, by a rough horizontal ridge, united to the inferior turbinated bone. Its *Outer Surface* is in general uneven, and articulated with the inner surface of the maxillary bone. It presents, behind, a groove more or less deep, which contributes to the formation of the posterior palatal canal, and above, a small smooth surface which is seen in the zygomatic fossa.

254. The *Anterior Edge* of this portion of the bone is very uneven and thin, and is prolonged below into a very brittle bony plate, which contracts the entrance of the maxillary sinus, and is received into the slit of which we have made mention in describing that orifice.

255. The *Posterior Edge*, which is equally uneven with the last,

rests in a great measure upon the inner side of the pterygoid process. It is also frequently hollowed, in nearly its whole length, in order to be articulated to it, by a narrow groove, broader below than above. At its union with the guttural edge of the horizontal portion, there is observed a very prominent pyramidal eminence, inclined outwards and downwards. This is the *Tuberosity of the Palate Bone,* which fills up the bifurcation of the two wings of the pterygoid process. Above and within, this tuberosity is hollowed by three channels, of which the two lateral, uneven, and furnished with slight asperities, receive the summit of these wings, while the middle one, which is smooth and polished, completes the pterygoid fossa. The inner groove is the deepest. Below, it presents a narrow surface which belongs to the palatal arch, and in which are seen the orifices of canals leading into the posterior palatal canal. Externally, it forms part of the zygomatic fossa, and gives attachment to the outer pterygoid muscle, at the same time that it presents some inequalities for the purpose of uniting with the upper maxillary bone. In the latter place, it is perforated by the posterior palatal canal, which ceases to be in part formed in the maxillary bone.

256. Its *Upper Edge* is surmounted by two eminences, the anterior of which is larger than the other, a little deflected outwards, and is named the *Orbitar Process.* It is supported by a contracted portion, forming a sort of *neck* or pedicle, on the inner side of which there are observed a slight ridge which is articulated with the ethmoidal turbinated bone, and a small channel which belongs to the superior meatus of the nasal fossæ. Its form is such as to present five distinct surfaces: 1st, An *anterior,* uneven, inclined downwards, and articulated to the maxillary bone; 2dly, A *posterior,* deflected inwards and upwards, united to the sphenoid bone by means of some rugosities which form a cellule in the substance of the process and continuous with the sphenoidal sinuses; 3dly, An *outer,* smooth, inclined backwards, forming part of the zygomatic fossa; 4thly, An *inner,* inclined downwards, concave, frequently hollowed by a cell, and united to the ethmoid bone; 5thly, An *upper,* smooth and plane, forming the most retired part of the floor of the orbit, separated from the outer by a small blunt edge, which contributes to the formation of the sphenomaxillary fissure.

257. The other eminence of this edge, which is smaller, less elevated, broader, and laterally compressed, has received the name of *Sphenoidal Process.* Internally, it is smooth and concave, and forms part of the nasal fossæ; externally, it enters into the composition of the zygomatic fossa; at the upper part, where it is very narrow, it unites with the sphenoid bone, and presents a groove which forms the pterygo-palatal canal. In this direction also, it is articulated with the turbinated bone of the sphenoid.

258. These two processes are separated from each other by an almost circular notch, converted by the sphenoid bone into a hole, named the *Spheno-Palatal,* which corresponds to the nervous

ganglion of the same name, and gives passage to nerves and vessels which penetrate into the nasal fossæ. Sometimes the sphenoid bone does not in any degree contribute to the formation of this hole, which is entirely formed in the palate bone, a bony tongue then stretching horizontally from one process to the other. Very generally also the sphenoidal turbinated bone closes its summit.

259. *Structure and Development.* The palate bones are very thin, and almost entirely formed of compact tissue, presenting cellular tissue only in the processes and horizontal portion. Their development, which is yet but little known, appears to take place by a single point of ossification, situated at the place of union of the vertical, horizontal and pyramidal portions.

260. *Articulations.* This bone is articulated with the sphenoid and ethmoid bones, the sphenoidal turbinated bones, the upper maxillary bone, the lower turbinated bone, the vomer, and the opposite palate bone.

OF THE VOMER.*

261. The *Vomer* is an azygous bone, situated in the median line, and consequently symmetrical,† forming the posterior part of the septum of the nasal fossæ. It is thin, flat, quadrilateral, and smooth on its lateral surfaces, which only present vascular furrows, and a narrow groove at the lower part which marks the passage of the naso-palatal nerve. It is always covered by the pituitary membrane, and is frequently deflected to the right or left, or even perforated in the middle.

262. This bone has four edges. The first, or *Sphenoidal Edge*, which is the uppermost, constitutes the thickest part of the bone, and is divided into two laminæ, which enter into the grooves on the guttural surface of the sphenoid bone, and which receive into the cavity formed by their separation, the crest situated between these grooves. The surfaces of this articulation never unite in substance, because there exists between them, under the sphenoid bone itself, and under its turbinated bones, to which the vomer here forms some attachment, a small canal which always transmits vessels and nervous filaments to the substance of the ethmoid bone.

263. The *Supra-palatal edge* of the vomer is inferior, and is the longest. Broad, obtuse, and uneven anteriorly; thin and sharp posteriorly; it is received into the groove which exists between the united maxillary and palatal bones, as we have already said.

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* *Vomer*, a plough-share.

† It must not however be imagined that the bones situated in the median line are the only ones capable of being divided into two equal parts. Many others are equally symmetrical, as Dumeril has remarked. Of this kind, for example, are the phalanges of the fingers and toes.

264. Its *guttural edge*, which is posterior, is free, thin below, thick and bifurcated above, sometimes notched in the longitudinal direction, and separates the two posterior apertures of the nasal fossæ.

265. The *ethmoidal* or *anterior edge*, is marked in its whole extent, or at least in its upper half, by a deep irregular channel, which receives the lower edge of the perpendicular plate of the ethmoid bone above, and the cartilage of the septum naris below. This channel is continued into that of the sphenoidal edge. Sometimes it is wanting, and then the cartilage slightly overlaps the vomer on each side.

266. *Structure*, *Development*, and *Articulations*. The vomer is thin, compact, and transparent in almost its whole extent, and presents some traces of cellules at its upper part only. It originates by a single centre of ossification, which has the form of a channel. It is articulated to the maxillary and palatal bones, to the ethmoid and sphenoid, as well as to the turbinated bones of the latter.

OF THE INFERIOR TURBINATED BONE.

267. *Form*. The *Lower Turbinated Bone*, named also *Os Spongiosum Inferius*, is of a very irregular form, elongated from behind forwards, rolled up upon itself, wrinkled at its surface, differently formed in different individuals, and suspended over the inner surface of the upper maxillary and palatal bones of each side, in the nasal fossæ, where it determines the limits of the middle and inferior meatus. Its *inner* or *nasal* surface is convex and prominent, especially in the middle. It is covered by the pituitary membrane, reticulated and traversed in its whole length by two arterial furrows. Its *outer* or *maxillary* surface, which is smoother than the other, and free like it, is concave and belongs to the inferior meatus of the nasal fossæ.

268. The *lower edge* is free, spongy, rolled up upon itself from beneath upwards, thicker at the middle than at the extremities. The *upper edge* which is articular and uneven, presents behind a sort of spinous crest, which unites with a similar part of the palate bone, and before a small and very thin margin, furnished with minute asperities, which are articulated to the crest on the base of the fronto-nasal process of the upper maxillary bone. In the middle it is surmounted by a small pyramidal eminence, which ascends toward the lachrymal bone, and which completes with it the nasal canal, by some papyraceous laminæ which unite with the ethmoid bone, and by a kind of scale curved downwards in the form of a hook, which contracts in part the orifice of the maxillary sinus, in which it is engaged.

The two edges of this bone unite so as to form two *angles*, a *posterior* and an *anterior*. The former of these angles is sharper and more elongated; but both are superficially impressed by ridges which the corresponding upper maxillary and palatal bones present.

269. *Structure and Development.* The inferior turbinated bone is in general thin. Its surface, which is covered with vermicular marks, porous and spongy, has been for this reason considered by most anatomists as consisting of cellular tissue. This opinion, however, I believe to be erroneous. Portions of cellules, such as these, which are frequently inequalities or small spines, which sometimes pass through the bone from one side to the other, and which are neither lined by a medullary membrane nor moistened by a fatty juice, cannot be likened to the diploe of the bones of the skull, or to the areolæ of the short bones.

It is developed by a single point of ossification, which makes its appearance at the fifth month.

270. *Articulations.* The inferior turbinated bone is articulated to the upper maxillary, palatal, lachrymal, and ethmoid bones, by the various points already mentioned. Frequently, even in children, it occurs united with the latter bone, so that in many subjects the lower turbinated bone seems to constitute an appendage of the ethmoid, as Bertin has remarked. Sometimes it is intimately united to the aperture of the sinus; but it is always slightly attached to the horizontal crests of the palatal and maxillary bones.

OF THE NASAL BONE.

271. *Form.* The *Nasal Bones*, *(Ossa Nasi,)* are of small size, and occupy the interval existing between the two ascending processes of the maxillary bones. They are thick at the upper part, thin below. Their form, although in general quadrilateral, is excessively variable; and it is seldom that they are exactly the same on both sides.

272. Their *anterior surface*, which is covered by the pyramidal muscle and the skin, is traversed by a few small vascular furrows. It is concave from above downwards, convex transversely. At its middle part it presents the orifice of a hole which passes through the bone, and transmits a small vein to the pituitary membrane. This hole is frequently accompanied with several smaller ones. It is sometimes wanting in one of the bones.

273. Their *posterior* or *nasal surface*, which is concave, uneven, especially at the lower part, and narrower than the anterior, presents distinct furrows, and is lined by the pituitary membrane. The orifice of the vascular hole just mentioned is seen upon it.

274. *The upper edge* is denticulated, short, inclined backwards, thick, and united to the nasal notch of the frontal bone.

The *lower edge* is longer, thin, sharp, and inclined obliquely backwards and downwards. It joins the lateral cartilage of the nose, and presents in its middle a narrow notch for the passage of the nerve which is distributed to the lobe of the nose.

The *outer edge*, which is very long, uneven, and sloped, supports the ascending process of the maxillary bone, and is often furnished below with two or three small prominences in the form of teeth, which are received into holes formed on that process.

The *inner edge*, which is broad above, and narrow below, is articulated with the bone of the opposite side, forming a ridge with it behind, in which there is a groove for receiving the anterior extremity of the perpendicular plate of the ethmoid bone and the nasal spine of the frontal.

275. *Structure, Development, Articulations.* The nasal bones present cellular tissue in almost their whole extent, but especially at their upper and inner edges. They are developed by a single point of ossification. It is unnecessary to mention its articulations again.

OF THE LACHRYMAL BONE.

276. *Form.* The *Lachrymal Bones, (Ossa Unguis,)* which are the smallest belonging to the face, are placed at the inner and fore part of the orbit, occupying a quadrilateral irregular space situated between the frontal, ethmoid and superior maxillary bones. Their form corresponds to that of the vacuity in which they are placed. They present the following parts.

277. An *orbitar surface*, which is external, smooth, divided longitudinally and in the middle, into two portions, by a thin and prominent ridge, forming a sort of hook at its lower extremity. Before this ridge, which is sometimes wanting, there is a channel perforated with a multitude of minute holes, and entering into the composition of the *Lachrymal Groove.* It is covered by the walls of the lachrymal sac. Posteriorly, there is observed a plane surface, broader but shorter, and not cribriform.

278. A *nasal surface*, which is internal, and presents in its middle a groove which corresponds to the ridge on its outer surface. Anteriorly to this groove, there is observed an uneven surface, which belongs to the middle meatus of the nasal fossæ; and behind it, there are seen rugosities which correspond to the anterior cells of the ethmoid bone, and which cover it. Pretty frequently also some of these inequalities communicate above with those of the orifice of the frontal sinuses.

279. Four *edges*, an upper, a lower, a posterior, and an anterior. The *upper edge*, is short, uneven, and articulated to the internal obitar process of the frontal bone. The *lower*, is divided into two portions by the extremity of the external ridge. It unites before with the lower turbinated bone, by a thin plate, curved inwards, and elongated downwards, which contributes to form the nasal canal; and behind, with the inner edge of the obitar surface of the upper maxillary bones. Sometimes the middle hook of this edge is wanting, and in that case is substituted by a small super-

numerary unciform bone, which unites with the upper maxillary bone, to the outside of the superior orifice of the nasal canal. The third edge, which is *posterior* and very thin, joins the anterior edge of the orbitar surface of the ethmoid bone. The fourth, which is *anterior*, is marked with a small groove, into which is received one of the portions of the posterior edge of the fronto-nasal process of the upper maxillary bone.

280. *Structure, Development, Articulations.* The lachrymal bone is entirely compact, extremely thin, and even transparent. It is developed by a single point of ossification; and is articulated to the frontal and ethmoid bones, the upper maxillary bone, and the inferior turbinated bone.

OF THE MALAR BONE.

281. *Form.* The *Malar* or *Cheek Bone (os Malae)* is of an irregular square form, and is situated on the upper and lateral parts of the face, forming the orbit externally, and constituting the region of the cheek.

282. Its *outer surface*, which is convex anteriorly, flat behind, smooth, quadrilateral, and covered in a great part of its extent by the skin and the orbicularis palpebrarum, gives attachment below to the two zygomatic muscles, and presents in its centre one or more small holes, named *malar*, for the passage of vessels and nerves. These holes are the orifices of a canal whose course is very vague, and very little known.

283. *Its upper surface* is smaller, concave, and smooth, and constitutes part of the orbit. It forms a right angle with the outer surface, behind and above which it is situated. The posterior orifice of one of the malar holes is observed upon it. It is circumscribed posteriorly by an edge which is ragged above, where it is articulated to the frontal and sphenoid bones, and below, where it unites with the upper maxillary bone, but smooth in an angle formed at its middle part, which enters into the formation of the spheno-maxillary fissure. This edge is inclined backwards at its upper part, forwards and inwards at the lower, and is vertical in the middle.

284. The *posterior surface*, which is also concave, is smooth behind, where it forms part of the temporal fossa; but anteriorly it presents a rough triangular surface, by which it is articulated to the malar tuberosity of the upper maxillary bone. In its posterior half, there is observed the orifice of a small malar canal.

285. Of its four *edges*, two are *anterior* and two *posterior*. Of the two anterior, the *upper* is smooth, concave, rounded, and forms part of the circumference of the orbit; while the *lower* is uneven, rough, and connected with the maxillary bone. Of the two posterior, the *upper* is thin over the greater part of its extent, more or less twisted in the form of the letter *s*, and gives attach-

ment to the temporal aponeurosis; the *lower*, thick, especially at its fore part, uneven, nearly straight, and affords insertion to the masseter muscle.

286. These four edges form an equal number of angles by their junction. The *upper* angle is very prominent, thick, and denticulate, and joins the external orbitar process of the frontal bone. The *lower* angle, which is much shorter, is articulated to the malar tuberosity of the upper maxillary bone. The *anterior* angle, which is very thin and sloped, forms the same connection on the edge of the orbit; and the *posterior*, which is longer and more acute than the others, supports the summit of the zygomatic process of the temporal bone, with which it forms the zygomatic arch.

287. *Structure, Development, and Articulations.* The malar bone is in general thick and cellular; its development commences by a single centre of ossification; and it is articulated to the frontal, temporal, sphenoid, and upper maxillary bones.

B. OF THE BONE WHICH FORMS THE LOWER JAW, OR THE LOWER MAXILLARY BONE.

288. The *Lower Maxillary Bone (Mandibula)* is beyond doubt the largest of those which enter into the constitution of the face, of which it occupies the lower part before, while behind it ascends into the middle and posterior region. It is symmetrical, and of a parabolical form; but the extremities of the curve which it describes are raised at a right angle to the rest of the bone. The middle and horizontal portion is named the *Body*, and the parts which are vertical and situated behind are termed *Branches*. The lower jawbone may be divided into the following parts.

289. *Outer* or *Cutaneous Surface.* This surface is placed almost immediately under the skin at the fore part, but is more deeply seated behind. It is convex, and presents, in the median line, the *symphysis of the chin*, a sort of vertical line which indicates the point of union of the two pieces of which the bone consists in childhood, and which surmounts a projecting surface, more or less distinct in different subjects, rugose, and of a triangular form, with the summit turned upwards. This prominence is termed the *Mental Process.*

Above it, on each side, there is observed a superficial cavity, into which is inserted the levator menti, and more outwardly, immediately beneath the second small grinder, or the first, the external orifice of the lower dentary canal, which is named the *Mental Hole*, and which gives passage to the vessels and nerves of the same name. It is oval and oblique.

From the two inferior angles of the mental process, there arises, on either side, a slightly prominent line, which at first follows a horizontal direction, and afterwards rises obliquely backwards, to be continued into the anterior edge of the coronoid process. This is the *external oblique line*, into which are inserted the depressor labii inferioris, depressor anguli oris, and platysma myoides, and which is somewhat effaced at the middle. Along this prominent line, by the side of the alveoli, there runs a channel, which terminates at the inner side of the coronoid process, and gives attachment in its posterior half to the buccinator muscle. Lastly, at the back part, is the external surface of the ramus or branch, which is quadrilateral, somewhat uneven, and covered with the masseter muscle, which is attached to it.

290. *Inner* or *Lingual Surface*. This surface is concave, directed towards the cavity of the mouth, invested at its upper part by the mucous membrane of that cavity, furrowed in the middle by the symphysis of the chin, beneath which are observed four eminences named the *Genial Processes*.[*] They are placed in pairs above each other, the two upper giving attachment to the genio-glossi muscles, the two lower to the genio-hyoidei. These tubercles are often spinous; sometimes there are only two that are distinct.

Above the genial processes, are two cavities, which lodge the sublingual gland, and under them two rough depressions for the insertion of the digastric muscles; while just at their level arise the *internal oblique lines*, which are more prominent than the outer, especially at the back part, where they form a sort of rounded prominence. They ascend toward the coronoid processes, and give insertion anteriorly to the mylo-hyoidei muscles, and posteriorly to the superior constrictors of the pharynx.

Beneath the inner oblique line, and posteriorly, there is observed an oblong superficial cavity, in which is placed the submaxillary gland. In this cavity is also seen a furrow which ascends towards a pretty large irregular hole, which forms the entrance of the *Maxillary* or *Inferior Dentary Canal*. This hole presents a very distinct spine above, and in the rest of its circumference several inequalities for the insertion of the internal lateral ligament of the jaw. It gives passage to the vessels and nerve of the same name, of which a branch runs along the furrow situated under it. This orifice occupies the centre of the inner surface of the branches of the jaw, which is marked at its lowest part with inequalities, to which are attached the fibres of the pterygoideus internus.

291. The *Lower Edge*, which is also named the *base of the jaw*, is horizontal, rounded, obtuse before, contracted behind, and traversed at the distance of two-thirds of its length from the chin, and opposite the second large molar tooth, by an ascending channel, which corresponds to the facial artery. It presents a remarkable bulging in the middle of its course, and gives attachment to the platysma myoides.

292. The *Upper* or *Alveolar Edge* is of considerable breadth, more so, however, behind, where it is a little deflected inwards,

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[*] Γένειον, *mentum*.

than before, where it retains its straightness. In its substance there are formed most commonly sixteen *alveoli*, sometimes only fourteen or fifteen, and in a few rare cases eighteen, which are intended for the reception of the teeth, and constitute together the *Lower Alveolar Arch.*

As in the upper jaw, the alveoli vary in their form according to the kind of teeth which they receive. The two middle are the smallest and narrowest; those which succeed them are a little larger; but the third on each side, which contains the canine tooth, is evidently the deepest. Those of the small grinders, which come next, are shorter, and are commonly single. The sixth on each side, which is square and generally divided into two, is the largest. The seventh preserves nearly the same dimensions and form; but the eighth contracts, becomes triangular, and in many cases presents only a single cavity. Its inner wall forms a remarkable prominence above the oblique line, and is much thinner than the outer. All these cavities are perforated, at their summit, by small apertures for the passage of vessels and nerves which are distributed to the teeth. The alveoli form prominences and depressions of various sizes on both sides of the dentary arch externally, corresponding to their cavities and the intervals by which they are separated. These prominences are always larger at the fore part of the jaw than on the sides or behind, where sometimes they are not observable at all. These parts are covered by the gums.

293. The alveolar arch is surmounted posteriorly by the *coronoid process*,* a triangular eminence, slightly inclined outwards at its summit, varying as to size, acuteness and general direction in different individuals. It seems to arise anteriorly from the union of the outer and inner oblique lines, which approach each other as they ascend, leaving in their interval a groove into which the buccinator muscle is inserted. The oblique line is prolonged on the inner surface, and forms there a pretty considerable projection. The summit of this process is embraced by the tendon of the temporal muscle. Its outer surface corresponds to the masseter muscle, the inner to the pterygoideus internus.

294. *Posterior* or *Parotideal Edge.* This edge is free, blunt, nearly vertical, and forms, with the lower edge, the *angle* of the jaw, which is more or less obtuse, seldom straight and frequently deflected outwards. Externally the angle gives insertion to the masseter, internally to the pterygoideus internus, posteriorly and between these muscles to the stylo-maxillary ligament.

The posterior edge, which corresponds nearly in its whole extent to the parotid gland, becomes gradually broader toward its upper part, and is terminated above by an oblong convex eminence, higher within than without, bent forwards, and directed obliquely inwards and backwards, so that its axis, if prolonged, would form an angle of from 110 to 136 with that of the opposite side. This eminence is the *condyle*, and serves to articulate the lower jaw with the temporal bone, being for that purpose covered with cartilage. At the back part, it gradually loses its convex form. Anteriorly it is distinctly curved, and presents an uneven ridge at the place where the cartilage ceases. Externally, it presents a small tubercle which gives attachment to the external lateral ligament of the joint. The condyle is supported upon a sort of pedicle named its *Neck*, which is marked anteriorly by a depression into which the pterygoideus externus is inserted, and also gives attachment, externally and above, to the external lateral ligaments. The condyle is separated from the coronoid process by the *sigmoid notch*, which is traversed by the masseteric nerve and vessels.

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* So named from its resemblance to the beak of a crow, *in Greek* κορωνη.

295. *Structure.* The lower maxillary bone is formed of a thick plate, bent upon itself, compact externally, cellular within, and traversed in the greater part of its extent, by the *inferior dentary canal.*

This canal, whose position varies at different periods of life, passes obliquely through the substance of the bone, gradually diminishing in size as it proceeds, at the base of the coronoid process and under the summits of the alveoli, from the middle of the inner surface of the branches of the jaw to the incisors; after which it turns back upon itself, forming an angle, and terminates at the mental hole. From the angle formed by its reflection there arise two small subordinate canals, one inferior, the other superior, which lose themselves in the cellular tissue of the jaw. It is lined in its whole extent by a plate of compact tissue, which is especially apparent near its orifices, for in the middle part it is so perforated with holes as to appear cellular. Of these holes, some which are larger penetrate into the alveoli so as to perforate their summit; the others transmit vessels into the areolar tissue of the bone which is very abundant. Sometimes the partition which separates the canal from the alveoli happens to be wanting, in which case the canal is exposed when the teeth are taken out. The walls of the alveoli and their partitions are very spongy.

It ought also to be remarked, that the dentary canal is nearer the inner surface of the jaw in the two posterior thirds of its course, and approaches the outer surface in the remaining third.

296. *Development* and *Articulations.* The lower jaw-bone originates by two centres of ossification, which unite at the symphysis of the chin. In very young fetuses, there is observed, moreover, a bony plate which forms the lower edge of the bone, and a separate nucleus for the coronoid process. It is articulated to the temporal bones by the condyles, and to the sixteen lower teeth.

C. OF THE TEETH.

297. The *Teeth* (*Dentes*; Οδοντες,) are small bones, extremely hard and compact, implanted in the alveoli of both jaws, which, in their

mode of connection and formation, present a certain analogy to horns, and thus differ in many respects from the other bones of the body. The teeth, in fact, are exposed in a great part of their surface to the contact of the air, while the other bones of the body are completely shielded from it. Their number varies at the different periods of life, while that of the other bones in general is always the same. The other bones continue without being replaced until death; when death is the effect of old age, the teeth, on the contrary fall, out before it arrives, and even then they are not the same that existed during childhood. Their colour is commonly of the purest white; their hardness is even greater than that of the petrous process of the temporal bone; they have no periosteum; lastly, their mode of development and nutrition is peculiar to themselves, and they are formed of two different substances, and not merely of two tissues of the same nature.

298. The teeth have in general the form of a very irregular conoid, of which the base is directed toward the cavity of the mouth, while the apex, which is single or divided, and always perforated, corresponds to the bottom of the alveoli.

In each of them there is distinguished a part situated external to the alveolus, and covered by a vitriform substance, which is named the *Crown*. It is bounded by a contraction termed the *Neck*, which separates it from another portion entirely concealed in the substance of the jaws, and which is the *Root*.

We shall now examine the particular characters which these two parts present in the adult, in the different kinds of teeth, of which there are generally thirty-two, sixteen in each jaw, and which are divided into three classes,—*Incisors*, *Canine Teeth*, and *Grinders*. We would also observe, that they are all articulated with the alveoli by gomphosis, and in such a manner as to be almost absolutely immoveable, and that in the recent state their root is surrounded by a prolongation of the mucous membrane of the mouth, which is named the *Alveolo-dentary Periosteum*.

OF THE INCISORS.

299. The *Incisors*, (*Incisive* or *Fore Teeth*, *Incisores,*) are eight in number, four in each jaw, of which they occupy the middle and fore part. Their *Crown* is of the form of a wedge. It is quadrilateral, compressed from before backwards, broad and thin towards the free edge, contracting and becoming thicker towards the root; slightly convex, smooth and polished anteriorly, concave and of somewhat less extent behind, where it is limited on each side by a triangular narrow plane surface, the base of which is turned toward the root, and which is contiguous to the neighbouring tooth. The layer of enamel which covers the crown externally, is thinner behind, and especially at the sides, than before, and is circumscribed towards the neck, anteriorly and posteriorly, by a

parabolic margin. The *Root* of these teeth is always single, very long, of a conical form, transversely compressed, slightly furrowed on each side in the longitudinal direction, pointed, and a little thicker before than behind.

300. The *Incisors of the upper jaw* are stronger and larger than those of the lower jaw. They are also thicker and broader. Their axis, which is directed downwards and forwards, is a little inclined toward that of the neighbouring tooth, in such a manner that they tend toward each other, and are separated in pairs by a triangular space having its base directed upwards. Those which are situated in the middle are larger and more solid than the others; their root is also more rounded; their free edge is sloped in the form of a chisel, at the expense of the posterior surface, and is perfectly straight. The lateral incisors, which are smaller, have their free edge oblique, with its more prominent angle toward the corresponding middle incisor.

301. The *Lower Incisors* are smaller than the upper; those which form the middle pair are surpassed in volume and extent by the lateral, and have their axis vertical, while in the latter it is inclined upwards and outwards. The free edge of their crown is cut obliquely on the anterior surface. It is straight and horizontal in the middle ones, a little oblique in the lateral, but in such a manner that its more prominent angle is next the canine tooth. Their root is much more compressed and more deeply furrowed than that of the upper, and it is also longer.

OF THE CANINE TEETH.

302. The *Canine Teeth, (Dentes Canini, Cuspidati, Laniarii,)* are four in number, two in each jaw. They are situated laterally of the incisors, and present fewer differences than they. Their *Crown* is conical, very convex anteriorly, a little concave and uneven posteriorly, terminated by a blunt summit, which is pretty frequently surmounted by a sort of small pyramidal tubercle rising above the level of the other teeth. Their root is single like that of the incisors, but much longer and thicker. It is also, like theirs, compressed and furrowed on the sides. Not unfrequently it projects before the alveolus, beyond the parabolic curve of the dentary arch, especially in the lower jaw, where it sometimes appears partly bifurcated. The layer of vitreous matter which invests its crown is thicker than in the incisors, and in the same manner describes two slight curves before and behind toward the neck.

The *Upper Canine Teeth* are the longest in the jaws, and for this reason are vulgarly denominated *Eye-teeth.*

The *Lower Canine Teeth* are situated a little more anteriorly, so that their summit corresponds to the space between the upper canine tooth and the lateral incisor.

OF THE GRINDERS.

303. The *Grinders, (Molar Teeth, Molares,)* are in number twenty, there being ten in each jaw. Very frequently, however, there are only sixteen or eighteen, and in some very rare cases twenty-two or twenty-four are observed. They occupy the farther part of each aveolar arch, and present a *Crown* which is broader than high, and a *Root* more or less divided.

304. The *Upper Grinders* are pretty generally stronger than the lower. Their axis is inclined outwards, and is sometimes vertical. In those of the lower jaw, it is directed inwards.

305. The first two pairs of grinders in each jaw have been designated by the name of *Bicuspidati.* They are smaller than the canine tooth which they follow. Their crown is irregularly cylindrical, flattened before and behind, where it is contiguous with the neighbouring teeth, and surmounted by two conical tubercles separated by a groove which follows the direction of the alveolar arch. The outer of these tubercles is more prominent and larger than the inner. They are more distinct in the upper small molares than in the lower, in which they are so disposed as to leave two small depressions between them. The outer presents, on the side opposite the other, irregular depressions and small points, which render its surface very uneven in that direction. The root is generally simple, sometimes bifurcated at the summit, especially in the upper jaw, but seldom entirely double. It presents on each of its surfaces a very deep groove, and is separated from the crown by a nearly circular neck. Its summit is pierced by two holes.

306. The next three on each side are called the *Large Grinders* or *Multicuspidati*, and are in general remarkable for their great size. Their crown, which is nearly cubical, slightly rounded externally and within, and flattened in the other directions, manifestly exceeds the level of the small grinders on the outside of the arch. On its upper surface there are observed four or five pyramidal tubercles separated by very distinct grooves. Their root, which is shorter than that of the small grinders, is divided into two, three, four or five branches, which all present an aperture at their summit, although they vary as to their degree of divergence, direction and inclination, as well as to their length, and the smoothness or roughness of their surface. The enamel descends a little lower upon the free faces of these teeth than upon the sides by which they touch each other. Their neck is very distinct.

307. The *first of the large grinders* is the broadest and largest of all. Its crown has commonly three outer and two inner tubercles. In the upper jaw, its root is triple or sometimes quadruple; in the lower, it is only double.

308. The *second large grinder* is a little smaller. In the lower jaw, its tubercles, which are four, are separated by a crucial groove; but this arrangement is much less regular in the upper, where the

crown has a rhomboidal form, and where the two external branches of the root have a vertical direction, are placed close together, and are smaller than the third, which is internal, and diverges much from the others. The latter character is common to it with the preceding tooth.

309. The *third large grinder* does not make its appearance until long after the others, on which account it is called the *Wisdom Tooth.* It is smaller than the second, and its axis is still more evidently directed inwards. Its crown is rounded, and furnished with three or four tubercles. Its root is generally simple, short and conical; but in the upper jaw it is sometimes quadrified.

310. The crown of the teeth increases in breadth from the incisors to the first large grinder, and then diminishes to the last. Their roots diminish in length from the canine tooth to the wisdom tooth. Lastly, from the first tooth to the last, the part exposed beyond the alveoli and gums, diminishes also.

STRUCTURE OF THE TEETH.

311. The teeth appear to be formed of a harder and more compact bony tissue than any that enters into the composition of the other parts of the skeleton. The part of them which rises above the alveoli is covered with a still harder layer, having a vitreous aspect, to which the name of *Enamel* is given.

The *bony portion* of the teeth, or the *Ivory,* forms a very dense mass which constitutes the whole of the root and the centre of the crown, and which is less brittle and more tenacious than the enamel. By chemical analysis, it gives nearly the same results as the other bones, with the exception of some traces of fluate of lime; yet its tissue never contains areolæ or medullary cellules, and whatever may be the size of the tooth, neither vessels nor injections can penetrate into it. Its fractured surface is commonly silky or lustrous like satin. There are perceived in it, although with difficulty, concentric fibres, which seem parallel to the surface of the tooth. It strongly resists the action of the air, and it is well known that in sepulchres which are discovered after a long series of ages, the teeth present themselves untouched in the midst of the remains of the skeleton reduced to powder. Once formed, this substance is perfect, and undergoes no sensible change.

The *enamel of the teeth* is of a milk-white colour, and is hard enough to strike fire with steel. Its surface is extremely smooth and polished. If it be separated from the bony portion, it loses part of its lustre, becomes semitransparent, and seems to present a fibrous texture. The layer which it forms is thicker in the places where the teeth rub upon each other, and much thinner toward the alveoli; seeming to terminate gradually toward the neck, as may be especially seen in the incisors. Hunter observed that its fibres are straight and radiated toward the summit of the crown, where they seem to converge into the axis of the tooth, while toward its base they become more and more curved, and sometimes even cross each other in this direction. The fibres of the enamel are perpendicular to the surface of the tooth, and consequently have a direction the reverse of that of the fibres of the bony portion; for which reason, when seen with the microscope, they have the appearance of velvet. They are also laid very close together, and are connected by one of their extremities to the bony portion, from the surface of which they seem to rise.

By the action of caloric, the enamel blackens, on account of its containing a small quantity of gelatin, but more slowly than the bony portion. It then cracks, and at length melts, if the temperature is elevated to a high degree. It dissolves in nitric acid, where it leaves light flakes of a whitish colour, but never a parenchyma retaining its form.

According to Berzelius, it is composed of phosphates of lime and magnesia, carbonate of lime, membranes, soda and water.

Like most calcareous substances, it may be artificially made to assume various colours. The natives of the Pelew Islands stain their teeth black with the juice of certain plants. It is well known that they become livid for some time when mulberries are eaten, and Loeseke* asserts that the use of madder reddens them in a very permanent manner; but this is doubtful.

The enamel contains no vessels, and is not renewed when destroyed; the opinion advanced by the celebrated Mascagni, that it is entirely formed of absorbent vessels, cannot be admitted.

312. The summit of each root or of its divisions is perforated by the orifice of a canal, which enlarges at the same time with the root, and penetrates into a considerable cavity formed in the crown, and like the hole at the summit of the root developed in the inverse ratio of age. The walls of this cavity are smooth, and it is filled with a soft gelatinous-looking substance, which is named the *nucleous* or *pulp* of the tooth, and in which there occur many nervous and vascular ramifications, to which the name of *dentary* or *alveolar* is given.

313. The teeth, which present no particular differences in the sexes, but which vary much according to age, as well as in different races and even individuals, present a multitude of anomalies and varieties in their number, form, positions, consistence, and structure. Many authors have collected examples of these variations, which it is more curious than useful to know. I shall mention a few of them.

1st. *Varieties of number.* The cases in which more than sixteen teeth occur in each jaw, are extremely rare, it being more frequent to find the number incomplete, although this is almost always owing to the last tooth remaining concealed in the alveolus. Borelli† saw a woman, however, who lived to the age of sixty without ever having teeth. Pyrrhus, king of Epirus, according to Pliny's account, had all the crowns of the teeth united. Pliny relates the same of the son of Prusias, king of Bithynia. Soemmering* has in his cabinet two teeth united in this manner. The lateral incisors have been seen wanting, in which case the middle pair were so enlarged as to occupy their place. It is much rarer to see a supernumerary incisor; yet Plouquet† mentions his having seen five in the lower jaw, &c.

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* Obs. xlvi. and xlvii.

† Obs. cent. ii. p. 41.

2d. *Varieties of form.* The upper incisors have been seen curved upwards in the form of a hook.‡ Cheselden speaks of a molar tooth which seemed to penetrate another.§ There are examples of roots of incisors that were double or triple. Those of grinders are often undulated or convergent. Bertin says, that sometimes the root of the canine tooth enters the maxillary sinus, where it appears exposed.|| Sometimes, on the contrary, the upper incisors are destitute of roots and alveoli, &c.

3d. *Varieties of Position.* The teeth which in this respect deviate least from the normal state are the supernumerary teeth, which are formed in the natural row, or nor far from it. But they may be developed in many other places. Thus teeth have sometimes been met with on the palate,¶ and even in the pharynx.** Albinus mentions the case of two canine teeth of considerable length and size, which were concealed in the substance of the nasal process of the upper maxillary bone, and of which the body was directed upwards and the root downwards. Barnes found one in the orbit.†† Those which have been observed in the ovaries were more probably the remains of extra-uterine conception.‡‡

4th. *Varieties of stucture and consistence.* These varieties are in general few in number, and are almost all dependent upon morbid causes. In the Ephemerides of the Academia Curiosorum Naturæ, mention is made of cartilaginous teeth. The stories told of gold and iron teeth are not worth repeating.

314. The teeth, whose direction is in general vertical or nearly so, are articulated with the alveoli of the two jaws. Their development presents very remarkable phenomena, respecting which we cannot here speak at length. Let it suffice to say, that the bony substance is deposited not *in* but rather *upon* the germ of the tooth, and that its outer laminæ are first formed.

The incisors and canine teeth are produced from a single centre of ossification. The grinders have one for each tubercle.

315. By their continuous series, the teeth form in the alveolar arches, two parabolic curved lines which are named the *dentary*

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* *De Fabr. corp. hum.* t. i. p. 204.

† *Dissert. ætat. hum. earumque jura sistens.* Tub. 1778. p. 8.

‡ Soemmering, l. c. p. 20.

§ Osteogr. t. ix. p. 7.

|| Osteol. t. ii. p. 241; Winslow, No. 372.

¶ Pliny, lib. ii. 138; Eustach. *lib. de dentibus*, c. xxix; Sabatier Anatom. t. i. p. 75.

** Schenek de Grafenberg. lib. i. p. 189.

†† Medical and Chirurg. Transact. vol. iv. no. 18. p. 316.

‡‡ Tyson, Needham, Ruysch, Cocchi, Baillie, Nysten, Blumenbach, Dumas, Baudelocque, &c. have observed this phenomenon.

arches. These arches, which are unequal, form together an oval, whose large extremity is represented by the upper arch, and the smaller by the lower. Their free edge in both is thin and simple anteriorly, thick and double on the sides.

D. OF THE HYOID BONE.*

316. The name of *Hyoid Bone (os Hyoides ossa Lingualia,* Soemm.*)* is given to a bony arch, of a parabolical form, convex anteriorly, suspended horizontally in the midst of the soft parts of the neck, between the base of the tongue and the larynx, entirely separated from the rest of the skeleton, and composed of five distinct bones, capable of moving on each other, and connected by ligaments.

317. The piece which occupies the centre of the arch is named the *Body* of the bone. It is the largest and broadest. It is flattened from before backwards, and is of a quadrilateral form. Its *anterior surface* is uneven and convex in the middle. It is divided by a prominent horizontal line, rather indistinct on the lateral parts, into two portions, which are themselves divided into two small cavities by a ridge cutting the horizontal line at right angles. This surface gives attachment, from below upwards, to the digastric, stylo-hyoidei, mylo-hyoidei, genio-hyoidei, and hyoglossi muscles. The *posterior surface* of the body is concave and smooth; and is filled by a yellowish cellular tissue which separates it from the epiglottis. Its *lower edge* is longer and more unequal than the upper. It gives attachment externally to the sterno-hyoidei, omo-hyoidei, and thyro-hyoidei muscles, and at the middle to the thyro-hyoid membrane. The *upper* edge gives insertion to the fibres of the hyo-glossus. On each of the *lateral edges*, which are less sharp than the upper and lower, there is placed a slightly convex cartilaginous facet which is joined to the lateral pieces.

The body of the hyoid bone, such as we have described it above, has been called the *Middle Hyoid Bone* by the anatomists of the German school.

318. The two lateral pieces, which are also known under the names of *Cornua*, *Branches* or *Inferior Hyoid Bones,*† are longer but much narrower than the body. They are broader and stronger before than behind, contract in the middle, and terminate posteriorly in a small rounded head, covered in the recent state, by a cartilaginous substance. Anteriorly, they present a plane surface which corresponds to that of the lateral edges of the body of the bone. At the upper part they are limited by a smooth and sharp falciform edge, into which are inserted the hyoglossus and constrictor pharyngis medius. Below, they give insertion to the thyrohyoid membrane. To their *outer surface* are attached the digas-

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* ʽΥ and ἐιδος, *forma,* it being supposed to resemble the Greek letter Upsilon.

† They are also by some named *greater* or *laryngeal horns* of the hyoid. K.

tric and thyro-hyoid muscles. The *inner* is lined by the mucous membrane of the pharynx.

In the same subject, they frequently present great differences in their form and size, on the different sides.

319. The two upper pieces, called also the *Small Horns*, or *Superior Hyoid Bones*, are short, pyramidal, inclined backwards and upwards, and terminated by a more or less prolonged point. They give attachment below to some fibres of the genio-glossus muscle, and above to the stylo-hyoid ligament.

It is not rare to find one of these pieces twice as long on one side as on the other, and this side is almost always the left, as Duvernoy and J. F. Meckel have remarked.

320. *Structure*, *Development*, and *Variations*. The hyoid bone contains much cellular tissue in its body; its branches are much more compact. It commences its development toward the conclusion of the fœtal life by five centres of ossification, one for each of its portions. Sometimes, in advanced age, all these portions unite into a single piece. The stylo-hyoid ligament has also been observed, by becoming ossified, to permit the styloid process to be directly united to the small horns. It also pretty frequently happens that one of the branches, as we have already said, is longer and more curved than the other.

E. OF THE FACE IN GENERAL.

1st. CONFORMATION.

321. Without reckoning the hyoid bone, which belongs to the face only as a very remote appendage, and which does not really enter into its composition, we shall distinguish in this part of the head, which is very symmetrical, several very unequal regions, which we shall describe in succession, with the exception of that which occupies the upper part, and which is confounded with the skull. Nor shall we here treat particularly of the sutures, as we did with respect to the skull, for they have no longer the same mutual relations.

322. *Anterior Region*. This is what constitutes the *Face* properly speaking. It extends vertically from the upper edge of the nasal bones to the chin. Its external limits are formed by the cheek bone, the projecting ridge which descends under the malar tuberosity, and the external oblique line of the lower jaw. It is very broad at its upper part, and especially between the two cheek bones; but the breadth gradually diminishes from the upper third downwards.

323. At the middle and upper part of this region, there are observed marked inequalities which connect the nasal bones with the frontal, and form a suture which surmounts the *Nose* itself, a pyramidal eminence, more or less prominent in different subjects, which forms a sort of vault inclined forwards, narrow above, broad below,

longitudinally concave in the former direction, convex in the latter, and much prolonged below by its lateral parts, which are directed outwards. This vault is formed by the nasal bones and the nasal processes of the maxillary bones. It is intersected in the middle by a longitudinal suture, which is sometimes inflected on one or other side, or may even present sinuous curves, and which results from the union of the nasal bones by mere juxta-position without denticulations. On the sides of this suture are the insertions of the pyramidal muscles of the nose, and one or more small vascular apertures, as well as another longitudinal suture formed by the nasal bones and the nasal process of the maxillary bones, which is also commonly the result of a mere apposition of surface, although in many cases one of the surfaces presents small straight projections, which are received into cavities formed in the other.

324. The denticulations at the top of the nose are continued laterally over the summit of the nasal processes of the upper maxillary bones, and seem intersected by the lower and lateral parts of the margins of the orbits, which present below, the articulation of the malar tuberosity with the cheek bone, and outwards and a little upwards, inequalities which occupy the upper angle of the latter bone. Behind, and a little above these margins on each side, are the malar holes and the insertions of the large and small zygomatic muscle into the cheek bone, which, a little to the inside, forms a suture with the maxillary bone. This suture limits the canine fossa above, and terminates at the concave ridge which descends from the malar tuberosity, and which limits that fossa behind. Above the canine tooth is the infra-orbitar hole, and below, the insertion of the canine muscle.

325. Between the two canine fossæ and under the nose, is observed the *anterior orifice of the nasal fossæ*, which is heartshaped, broader below than above, and formed by the nasal and upper maxillary bones. It is sharp and uneven in its upper part, and rounded below. Above and in the middle, it presents a prominence formed by the union of the nasal bones, and limited laterally by the small notches which give passage to the nerves distributed to the lobe of the nose. Below, it presents the *anterior nasal spine*, which surmounts a vertical suture, without denticulations, on the sides of which are the myrtiform fossæ, and which is produced by the articulation of the upper maxillary bones with each other. This suture forms a right angle with the upper alveolar border, under which are seen the aperture of the mouth and the two *dentary arches*.

326. These two arches, which are formed by the teeth arranged in continuous series, are, as has already been said, most commonly of a parabolic form. Sometimes their curve belongs to the half of an ellipse or oval; and occasionally they form angles at the part where the incisors meet the canine teeth. The upper arch is a little wider than the under, on which account, the latter appears embraced by it, when the jaws are brought together.

327. The free edge of these arches is undulated in such a manner, that in the upper jaw it descends slightly from the first incisor to the second grinder on each side, and again ascends, which renders it necessary for the last teeth of the lower jaw to be situated higher in order to reach the corresponding teeth in the upper jaw. This arrangement is particularly evident in the heads of women. This edge is simple at its fore part, but posteriorly presents two lips, on account of the greater breadth of the grinders. The outer lip is sharper in the upper jaw than the inner; but the reverse is observed in the lower jaw.

328. From the first incisor to the first large grinder, the teeth gradually increase in size, and afterwards diminish. Their length, however, is in general uniform, otherwise mastication would be hampered. The intervals by which they are separated are very small; and they are always more extended on the side of the roots, which gives them a triangular form.

329. If we are to give credit to observers, the dentary arches have sometimes been seen double or even triple. One of the sons of Colombo furnished that anatomist with an example. According to Thomas Bartolin, Louis XIII. of France presented the same anomaly. This arrangement, however, is of rare occurrence; but it not unfrequently happens, in consequence of some disorder in the second dentition, that some of the teeth are double.

330. Below the inferior dentary arch, there are observed, in the middle line, the symphysis and eminence of the chin, and on each side, the mental hole, the external oblique line, and the insertion of the levator menti, the quadratus and triangularis labiorum, and the platysma myoides.

331. *Posterior* or *Guttural Region.* This region is much broader than high, and extends transversely from one of the parotideal edges of the lower maxillary bone to the other, and vertically from the posterior nasal spine to the upper edge of the vomer. In the middle, it presents the posterior edge of this bone, and its articulation with the palatal bones. On the sides, there is first observed the *posterior aperture of the nasal fossæ*, which is higher than broad, and of an elliptical form. At the upper part of this orifice, is the portion of the pterygo-palatal canal, which is formed in the palate bone. At its outer part, is seen the tuberosity of the palate bone; and externally of the latter, between it and the branches of the jaw, there occurs an empty space, filled in the recent state by the outer pterygoid muscle. Lastly, the parotideal edge of the lower jaw limits this region laterally.

332. *Inferior* or *Palatal Region.* This region is naturally divided into two portions, one superior and horizontal, named the *vault of the palate;* the other vertical and inferior. The latter is formed by the inner surface of the dentary and alveolar arches, and by the lower maxillary bone; the former, by the upper maxillary and palatal bones united.

333. The palatal vault, which is invested with the membrane of

the same name, is of a parabolical form, and intersected longitudinally by a suture, formed by the union of the palatal and superior maxillary bones. This suture, which is destitute of indentations, is terminated posteriorly by the *posterior nasal spine*, to which is attached the levator uvulæ, and ends anteriorly at the lower orifice of the *anterior palatal canal*. This orifice, which is at first very wide, soon contracts, and then presents three apertures; two smaller lateral, situated the one to the left and behind, the other to the right and before; and a larger, middle and posterior, which is the termination of the canal itself. The two smaller orifices give passage to the naso-palatal nerves, while the canal contains a nervous ganglion of a peculiar structure, and bifurcates as it ascends, in such a manner as to open into each of the two nasal fossæ separately. On each side of the inferior orifice of the palatal canal, there are also seen the *foramina incisiva*, which are formed in the posterior lip of the anterior part of the alveolar margin, and are much more distinct in young subjects than in adults. A probe introduced at the aperture, penetrates into the alveoli of the incisors.

334. The longitudinal suture which we have just described is intersected posteriorly at right angles by another transverse suture, which is formed by the junction of the palatal and maxillary bones. It is limited, on each side, by a very uneven and slightly concave surface, which presents posteriorly the small ridge to which the external peristaphyline muscle is attached, and the orifice of the *posterior palatal canal*, which ascends between these two bones, and gives rise, in its course, to two or three small *accessory palatal canals*, which open upon the tuberosity of the palate bone. It transmits the vessels and nerves which bear its name.

335. The vertical portion of this palatal region presents the posterior surface of the two alveolar and dentary arches, separated by the aperture of the mouth; the posterior part of the symphysis of the chin; the *genial processes;* the two internal oblique lines; the fossæ, in which are contained the sublingual and submaxillary glands; the insertions of various muscles already mentioned, and the base of the jaw.

336. *Lateral* or *Zygomatic Regions.* Each of these regions is composed of two distinct parts, between which is observed the empty space which we have already pointed out in describing the guttural region. One of these portions, which is *external*, is formed by the branch of the lower jaw, which must be removed to see the other portion, which is *internal*, and limited anteriorly by the ridge which separates the canine fossa from the maxillary tuberosity. This tuberosity, on which are observed the orifices of the posterior dentary canals, seems to form the greater part of this region. Inferiorly, it is articulated to the palate bone by means of a small verticle suture, behind which there occurs an excessively narrow triangular surface, belonging to the palate bone, and articulating posteriorly to the pterygoid process. At its upper part, above the tuberosity, is a portion of the upper maxillary bone,

which contributes to the formation of the *Pterygo-maxillary Fissure;* and behind it, there is observed a vertical suture, formed by the meeting of that bone and the palate bone. It is in this suture that the upper orifice of the posterior palatal canal is formed. All this region is surmounted by a large oblique surface, which forms part of the orbit.

337. Among the canals formed upon the maxillary tuberosity under the name of *posterior dentary*, there is one which penetrates almost directly into the alveolus of the wisdom tooth. Another opens into the cavity of the maxillary sinus. A third, which is lodged in the substance of the wall of that sinus, divides into several branches as it passes above the roots of the grinders.

2.—DIMENSIONS OF THE FACE.

338. The face is of much less extent than the skull, and does not form more than a third of the head in the adult. Its middle vertical diameter is much longer before than behind, where it is represented by the guttural edge of the vomer, while in the former direction, it extends from the chin to the upper part of the nose. The breadth of the face is nearly the same before and behind, where it is limited on each side by the parotideal edge of the inferior maxillary bone; but anteriorly, it is greater above than below, as we have already said. The place where the transverse diameter is shortest, is between the two maxillary tuberosities. The longitudinal diameter has also nearly equal dimensions above, where it extends from the root of the nose to the sphenoidal process of the palate bone, and below, where it is carried from the chin to the middle of a line drawn from one angle of the lower jaw to the other; but at the middle part it is much diminished, and is limited by the two nasal spines.

III.—OF THE HEAD IN GENERAL.

339. We mentioned that the head is the upper extremity of the trunk, and that therefore it is properly speaking an appendage of it. This we hope to render evident by showing, with M. Dumeril, that the head is merely a vertebra of which the different parts are excessively enlarged and form separate pieces. In fact, the occipital hole may be considered as being the commencement of the spinal canal; the basilar process and the body of the sphenoid bone correspond, in their structure and uses, to the bodies of the vertebræ, whose articular processes are represented by the occipital condyles, while the external occipital protuberance and the bony spaces comprised beneath it, are analagous to their spinous processes and plates, and, lastly, the transverse processes are repre-

sented by the mastoid processes of the temporal bone. This striking analogy is further strengthened by a comparison of the muscles which serve to move the spine and the head, and by the examination of the various modifications which these two parts present in the different classes of animals. It is, moreover, somewhat remarkable, that this analogy should be more especially evident in the part of the skull in which the commencement of the spinal marrow is lodged.

340. The head, when placed on a horizontal plane, rests upon the incisors and occipital condyles. The latter are so disposed as to be opposite the middle of a line drawn from these teeth to the most prominent point of the occiput. It is here, therefore, that the centre of gravity of the head is placed, and this is the reason why it is so well kept in equilibrium upon the spine. The plane of the occipital hole is also parallel to the plane of the palate, and it is for this reason that we have the mouth turned forwards.

It is, however, in the European only that we find these dispositions exactly such as we have represented them. In the negro, the anterior portion of the line mentioned is longer than the posterior, on account of the protrusion of the jaws; and in proportion as we descend toward the lower orders of vertebrate animals, we find this peculiarity more distinctly marked, as Daubenton has observed; for, in them not only are the jaws elongated, but the condyles are also removed backwards.

341. Although formed of the skull and face, which we have already fully described, the head still presents to our observation several circumstances resulting from the very union of these two parts. Thus, in the first place, four large cavities are formed in the head at the expense of the skull and face together. These are the *Orbitar Fossæ*, which contain the organs of vision, and the *Nasal Fossæ*, in which are placed the organs of smell. There are also two cavities of the same description which occupy its lateral regions, and which are named the *Zygomatic Fossæ*. Lastly, the *Temporal Fossa*, which we have seen formed in a great measure by the skull, is completed by the face.

OF THE ORBITS.

342. The *Orbits*, which are situated on each side and in the upper part of the anterior region of the head, and are perfectly similar in all their parts, have the form of a pyramid with the base turned forwards, but whose axis, being directed obliquely inwards, causes the summit to incline in that direction. Their walls represent four triangular surfaces, which unite so as to form laterally retiring angles.

343. The *upper wall* or *vault* is slightly inclined backwards. It is concave and formed, anteriorly by the frontal bone, posterior-

ly by the process of Ingrassias. Near its summit, and to the inside, it presents the optic hole, which is directed obliquely backwards and inwards, so that were its axis prolonged it would intersect the one or the other side at the pituitary fossa. Before it, is a portion of the sphenoidal suture of the skull; and, altogether anteriorly there are observed, to the outside the small fossa which lodges the lachrymal gland, and internally the inequalities to which the cartilaginous pulley of the obliquus major of the eye is attached.

344. The *Lower Wall* or the *Floor of the Orbit*, is nearly plane, and inclined outwards and downwards. It is formed at its fore part, by the cheek bone; in the middle, by the orbitar surface of the upper maxillary bone; posteriorly and inwards, by one of the small surfaces of the anterior process of the upper edge of the palate bone; and it is intersected, at the point where these bones meet, by two sutures whose denticulations are not very distinct, and of which the posterior is of very small extent. At its posterior and external part, is seen the infra-orbitar groove, to which succeeds the canal of the same name.

345. The *Outer Wall* is plane, and is formed, in three posterior fourths, by the sphenoid bone, and in the anterior fourth, by the malar. A vertical suture, with large serratures, marks the place where these two bones unite, and at its fore part are observed the internal orifices of the malar holes.

346. The *Inner Wall* is of much smaller extent than the others. It is smooth and perfectly plane. Three bones enter into its composition: the lachrymal before, the ethmoid in the middle, and the sphenoid behind. Two vertical sutures result from the juxtaposition of these bones, and present themselves under the appearance of two slightly uneven and very narrow slits.

347. The *Upper Wall* in uniting with the inner and outer, forms two retiring angles. The first of these angles contains, anteriorly, the suture which results from the articulation of the frontal and lachrymal bones, and a little behind this, the ethmoidal suture of the skull, in which are seen the internal orbitar foramina, to the number of two or three. The second presents posteriorly the sphenoidal fissure of the skull, and anteriorly the articulation of the frontal to the malar bone.

348. The *Lower Wall* also forms two retiring angles at the moment when it joins the inner and outer walls. The first presents the suture which results from the articulation of the upper maxillary and palatal bones to the lachrymal and ethmoid. The second is perforated posteriorly by the *Spheno-maxillary* or *Inferior Orbitar Fissure*. This fissure is formed at its upper part by the sphenoid bone, below by the upper maxillary bone, anteriorly by the malar bone, and posteriorly by the palate bone. It is less wide in the middle than at its extremities, is closed up by fat in the recent state, and gives passage merely to a few vascular and nervous ramifications.

349. The *Circumference* of the orbit, or its base, is irregularly quadrilateral, wider externally than within, directed obliquely downwards and outwards, and presents, at its upper part, the orbitar arch and superciliary hole, and at its lower, the articulation of the malar tuberosity with the cheek bone. It presents externally a short, denticulated suture formed by the cheek bone and the external orbitar process of the frontal bone; and internally the *Lachrymal Groove*, formed by the os unguis and the nasal process of the upper maxillary bone, and consequently divided into two portions by a longitudinal suture. This groove, which lodges the lachrymal sac, terminates below in the *Nasal Canal.* The circumference of the orbit gives attachment particularly to the orbicularis palpebrarum.

350. The *Axis* of the orbit, which forms a slight angle with that of the optic hole, is however, like it placed so obliquely that it would meet posteriorly that of the orbit, but at a point posterior to the intersection of the axes of these two holes. The inner wall alone proceeds directly backwards, parallel to that of the other orbit. The three others are inclined.

351. From what has been said, it is seen that the bones which enter into the composition of the orbit, are the sphenoid, ethmoid, frontal, upper maxillary, palatal, lachrymal and malar bones.

OF THE NASAL FOSSÆ.

352. These cavities are of an irregular form, which however is nearly that of a parallelopiped. They are broader below than above, longer in the contrary direction, higher in the middle than before and behind, and present several appendages, which are formed by the different sinuses that exist in the bones of the head, and of which we have already spoken. They are not exactly similar, the right to the left. They are separated from each other by an intermediate septum, formed by the perpendicular plate of the ethmoid bone above, and the vomer below and at the back part; and occupy the space situated beneath the anterior part of the base of the skull, above the mouth, between the orbits, the canine, temporal and zygomatic fossæ, and before the guttural cavity. Their walls, which are four in number, terminate anteriorly at the nose, and posteriorly at the throat.

353. The *Upper Wall* or *Vault* of the nasal fossæ is disposed in three different directions. Anteriorly, where it is formed by the bones of the nose, it looks backwards and downwards; in the middle, where there is seen the cribriform plate of the ethmoid bone, it is horizontal; posteriorly, where it belongs to the body of the sphenoid bone, it is turned forwards and downwards.

In the first portion, is observed the inner surface of the nose much narrower than the outer, surmounted by a crest towards the middle line, concave transversely, straight from above downwards, marked with a furrow for the internal nasal nerve, and perforated with one or two small vascular apertures. It presents externally the suture which joins the nasal process of the upper maxillary bone to the nasal bone.

At the union of the anterior with the middle portion, there is observed a somewhat indistinct suture, formed by the nasal notch of the frontal bone and the bones of the nose; then a small concave longitudinal surface, marked on the sides by the nasal spine of the frontal bone, and applied posteriorly upon the cribriform plate, the holes and small fissures of which are perceived farther back. This part of the vault is very thin and narrow.

Posteriorly, the cribriform plate forms a suture with the sphenoid bone and its turbinated bone. It is there that the third portion commences, in which are observed the lower and inner surfaces of the sphenoidal turbinated bone, and the orifice of the sphenoidal sinuses, which they concur to form, and which is sometimes wanting, as has been observed by Ingrassias, Reininger, Schneider, and some others. Very different from what it appears in a sphenoid bone separated from the others, here this aperture is narrow and regularly rounded, and it always occupies the upper region of the sinus. Lastly, beneath this latter, is the articulation of the vomer with the sphenoid bone. This region of the nasal fossæ is extremely thick, and of much greater extent than it seems at first sight to be, on account of the existence of the sinus, which prolongs it behind, and thus augments its surface.

354. The *Lower Wall* or *Floor* of the nasal fossæ is rectilinear, and does not vary its direction like the vault. It is concave transversely, and slightly inclined backwards. Before the superior orifice of the anterior palatal canal, it descends a little forwards, after being raised for a moment, and anteriorly it is prolonged a little more on the inner side than on the outer, on account of the anterior nasal spine. There is observed upon it the orifice of which we have just made mention; and just at the point of junction of the vomer with the maxillary bone, is seen the entrance of the small canal for the naso-palatine nerve, which is pretty constantly preceded by an arterial groove. Toward the posterior third of this wall, there is a kind of squamous suture, formed by the palatal and upper maxillary bones, and which is here much less distinct than it is on the palatal arch. Posteriorly, it is terminated by a notched edge, which is somewhat raised, and by the posterior nasal spine.

355. The *Inner Wall* of the nasal fossæ is the least complicated, and is formed by one of the surfaces of the septum which separates these cavities. Sometimes, in consequence of an original law of the organization, this septum is deflected sometimes to the one side, and sometimes to the other, but more commonly to the right, as Haller has observed. It is then observed that the inner wall of one of the nasal fossæ is concave, and the other convex. In other

circumstances, on account of the vertical plate of the ethmoid bone being laterally united to the anterior edge of the vomer, there occurs on one side a prominent oblique line, and on the other a corresponding groove; or there may also be observed an aperture of greater or less size.

This septum is composed of the vomer, the perpendicular plate of the ethmoid bone, a crest of the frontal bone, another of the nasal bones, and a third formed by the upper maxillary and palate bones.

It is marked by numerous vascular and nervous furrows; presents at its upper part the lower orifices of the internal olfactory canals; is cut anteriorly by a large triangular notch; and is terminated behind by the guttural edge of the vomer.

356. The *Outer Wall* of the nasal fossæ is that which presents the most important object of examination. At its upper and fore part, there is first observed the union of some transverse and irregular lamellæ of the ethmoid bone with the frontal bone and the nasal process of the upper maxillary bone, of which the internal surface is seen a little beneath, where it forms part of the middle meatus. A little farther back, is a rugose and quadrilateral surface of the ethmoid bone, perforated by a great number of olfactory canals, shaped like the point of a pen, more or less long and oblique. This surface becomes convex posteriorly, and directs itself outwards to unite with the sphenoidal turbinated bone, and with the sphenoid bone itself. From this arrangement, there results a vertical channel between the body of the sphenoid bone and the lateral masses of the ethmoid, which ends above at the orifice of the sphenoidal sinus, and below at the superior meatus. This same surface is prolonged forwards over the middle turbinated bone; but, posteriorly, it is suddenly limited by the *superior turbinated bone*, which is formed by a thin plate of the ethmoid bone, inclined downwards and backwards, convex internally, concave outwards, limited anteriorly by a cul-de-sac, gradually terminated behind by the vertical channel, and below determining the form and extent of the *superior meatus*.

357. This meatus is a kind of horizontal channel, occupying only the posterior part of the wall which we are describing, perforated anteriorly by one or two apertures, which lead into the posterior cells of the ethmoid bone, and posteriorly by the *spheno-palatal hole*, which is formed by the palate bone, the sphenoid bone, and frequently by its turbinated bone, which is sometimes double, and which always perforates directly the outer wall of the nasal fossæ from within outwards. This hole gives passage to the nerves and vessels of the same name, and opens into the spheno-maxillary fossa.

358. Beneath the superior meatus, is the *middle* or *ethmoidal turbinated bone*, larger and more curved than the upper, thin above and thick below, convex inwards, and concave externally. Its surface is wrinkled, and sometimes the small olfactory channels

are prolonged as far as its lower edge. It belongs to the ethmoid bone, and is terminated behind by free inequalities. It occupies only about the middle third of the outer wall of the nasal fossæ, and principally forms their *middle meatus*.

359. This meatus is of much greater extent than the upper, and presents from before backwards, 1st, A portion of the inner surface of the nasal process of the upper maxillary bone; 2dly, A suture which it forms with the lachrymal bone; 3dly, The anterior part of the inner surface of the latter bone, the pores with which it is perforated, and its union with the ethmoid bone; 4thly, A portion of this latter, which has a lacerated appearance, and is articulated to the upper maxillary bone; 5thly, The *infundibulum*, which leads into the anterior ethmoidal cells, and frontal sinuses; 6thly, The entrance of the maxillary sinus, which is contracted by the ethmoid bone, the inferior turbinated bone, and the palate bone, and situated toward the posterior third of the wall, always above the floor of the sinus. This aperture is sometimes double, and is further contracted, in the recent state, by a glandular organ, lodged in the substance of the pituitary membrane.

360. Beneath the middle meatus is the *inferior turbinated bone*, which presents the greatest number of variations, and seems suspended by its unciform process, which penetrates into the maxillary sinus. Bertin, Cheselden, and Haller, are of opinion, that it is most commonly an appendage of the ethmoid bone. Whether it be so or not, it lies over the *inferior meatus*, which consists of a horizontal channel, concave from above downwards, and straight from before backwards, formed above by the inferior turbinated bone; anteriorly, where it is broader, by the upper maxillary bone, and posteriorly, where it is contracted, by the palate bone.

361. The only thing remarkable that this meatus presents, is the *nasal canal*, which is situated anteriorly and concealed by the lower turbinated bone. This aperture is inclined a little obliquely backwards, and varies much as to its position with respect to the entrance of the nostrils, being sometimes but a line or two distant from it, and sometimes upwards of a finger's breadth. The *nasal canal* itself is formed by the upper maxillary bone, sometimes by itself, but more commonly united with the lower turbinated bone and the lachrymal bone. It ascends towards the lachrymal canal by describing a slight curve, the convexity of which is turned forwards and outwards. It is narrower at the middle than at the extremities. Its diameters are not all equal, it being a little compressed; and it is lined by a mucous membrane.

362. We have already spoken of the anterior and posterior apertures of the nasal fossæ. The very numerous bones of which these cavities are composed, are, the sphenoid and ethmoid bones, the sphenoidal turbinated bones, the frontal bone, the upper maxillary, palatal, and nasal bones, the inferior turbinated bones, and the vomer.

OF THE SUTURES FORMED BY THE UNION OF THE SKULL AND FACE.

363. Almost all the points at which these two parts come into contact present sutures with very distinct denticulations. Thus there is one situated transversely above the nose, and formed by the meeting of the nasal and upper maxillary bones with the frontal bone. It is continued laterally into those of the internal orbitar processes and lachrymal bones. Then there is observed, to the outside of the orbit, the suture which the frontal and sphenoid bones form with the malar bone; then that of the malar bone and the zygomatic process of the temporal bone; and lastly, the suture formed between the ascending portion of the palate bone and the pterygoid process. The latter is vertical, and very indistinctly marked. We ought also to include among the sutures of this class those which result from the articulation of the vomer with the sphenoid bone, of the inferior turbinated bones with the ethmoid, and of the latter bone with the palatal and upper maxillary bones, always observing that for the most part they present but very indistinct serratures, and that some of them even are nothing more than mere juxtapositions of surfaces.

OF THE TEMPORAL, ZYGOMATIC, AND SPHENO-MAXILLARY FOSSÆ.

364. We have already, in part, described the *temporal fossa.* When the head is entire, it is limited below by the *zygomatic arch*, a sort of bony projection formed by the temporal and malar bones. It is directed forwards, has a double curvature, so as to be at once convex above and concave below, and is separated from the rest of the bone by a large empty space, which is filled up by the temporal muscle. In its middle its presents a suture which results from the union of the two bones of which it is constituted, and which is so disposed that the temporal rests upon the malar, their edges being here oblique. This suture is very distinctly serrated. Before the zygomatic arch, the temporal fossa is completed by a portion of the posterior surface of the malar bone, in which are seen two or three small vascular apertures. Posteriorly, a transverse ridge, formed upon the sphenoid bone, separates this fossa from the zygomatic.

365. *Zygomatic Fossa.*—This name is given to the space comprised between the posterior edge of the outer wing of the pterygoid process and the ridge which descends from the malar tuberosity. We have already pointed out most of the objects that are met with upon it. What we have now to say, is, that the maxillary tuberosity is separated, above the pterygoid process, by a fissure which gives passage to the internal maxillary artery, and which Bichat has named the *pterygo-maxillary* fissure. It is vertical,

broad above, and narrow below. It unites in the former direction, nearly at a right angle, with the spheno-maxillary fissure; and below, it is continued into two small vertical sutures, very close to each other, only separated a little below, and formed by the articulation of the palatal bone with the pterygoid process on the one hand, and the maxillary tuberosity on the other. The pterygo-maxillary fissure leads into:

366. The *Spheno-maxillary Fossa.* This fossa, which is deep and narrow, and is continued behind the orbit, is formed by the sphenoid bone behind, the upper maxillary bone before, and by the palate bones to the inside. The sphenoidal, spheno-maxillary, and pterygo-maxillary fissures terminate in it, the whole appearing to form but one fissure. There are moreover observed five apertures upon it, which are, posteriorly and from above downwards, the anterior orifices of the maxillary foramen and of the vidian and pterygo-palatal canals; to the inside, the spheno-palatal hole, and at the lower part, the upper orifice of the posterior palatal canal.

OF THE RESPECTIVE DIMENSIONS OF THE SKULL AND FACE.

367. The two organs of taste and smell occupy the greater part of the face. The more these two senses are developed, the greater size does it acquire, and this at the expense of the skull, which is so much the larger compared with the face, the greater the development of the brain is.

It is also observed, that anteriorly the face has not a vertical direction, it being sensibly inclined forward. It is obvious that the more the skull is increased in size, the less marked does this inclination appear; and that the larger the cavities for lodging the organs of taste and smell are, the greater, on the other hand, must be the obliquity of the face.

Now, as the nature of each individual depends in a great measure upon the relative energy of each of its functions, and the senses in question are those of the brutal appetites; as the brain, on the other hand, is the seat of the intellectual faculties, there results that the form of the head, and the proportions of the two parts of which it is composed, may form an indication of the general constitution in this respect, and this so much the more distinctly the more that it has a given magnitude, and a determinate destination; that it has to lodge, on the one hand, the centre of the sensations and volitions, and, on the other, the organs of smell, mastication, and taste; that the skull and face are respectively appropriated to this twofold purpose, and that the given volume of the one cannot be diminished without inducing a corresponding augmentation of the other.

We see, in fact, that the animals whose muzzle is most elongated, are of all others the most stupid, of which kind are cranes, geese, and snipes; while, on the other hand, a high degree of intellect is attributed to those which have a very distinct forehead, such as the elephant and owl, the latter of which the Greeks gave as a companion to the goddess of wisdom. In man, who has received the noble prerogative of intellect, who has to exercise his mental more than his physical faculties, the capacity of the skull is much greater than that of the face.

In reptiles and many fishes, the mouth alone, with its two enormous jaws, constitutes almost the entire head; and they are the most voracious as well as the most ferocious of animals. They seem to live, as it were, only for the purpose of eating. Without going beyond our own species, we are led to consider as stupid and gluttonous, a man who has the lower part of the face very prominent; and artists, in their representations of heroes and gods, carefully avoid this projection, and make the forehead advance, so as to give the eyes the expression of habitual meditation.

368. It has been attempted, from these data, to estimate the relative proportions of the face and skull. One of the simplest means that have been employed for this purpose, is the *facial angle* of Camper, formed by the meeting of two ideal lines, one of which passes from the most prominent parts of the forehead to the edge of the upper incisors, while the other extends from the meatus auditorius externus to the same point. The more this angle approaches a right angle the more does the skull project forwards, and consequently the greater is the size of the brain; the more acute it becomes, the more elongated is the face, and the more are the organs of taste and smell developed. By enabling us therefore to estimate, in a certain degree, the relative proportions of the skull and face, it is capable of indicating, in some measure, the development of intellect in the individual.

In the heads of Europeans, this angle is generally 80 degrees. It is 75 in those of the Mongolian race, and only 70 in negroes. The Grecian sculptors, it is observed, have given their divinities a facial angle of 100 degrees. It becomes more and more acute, on the other hand, as we descend in the scale of animals, being larger in the mammifera than in birds, and in these latter than in reptiles and fishes.

369. But this means of estimating the relative dimensions of the skull and face, is little to be depended upon, because, in many cases the frontal sinuses swell out the skull so much as to raise the facial angle a great deal beyond what the proportion of the skull would require. This inconvenience, however, may be obviated, by employing the method proposed by M. Cuvier, who advises to view the skull and face in a vertical and longitudinal section of the head, and to compare the areas which these two parts may present. Now, in the European, the area of the skull is about four times that of the face; while in the negro, the latter increases about a fifth, and in the glires and solipeda, it becomes successively larger. It is easy in this manner to appreciate the individual differences.

V.—OF THE PELVIS.*

370. The *Pelvis* is a large irregular bony cavity, open above and below, which terminates the trunk beneath, supports or contains part of the intestines, urinary and genital organs, together with a prodigious quantity of blood-vessels, lymphatics, nerves, &c. and which, at the same time, affords articulation to the abdominal extremities, gives insertion to their muscles, and is subservient to the performance of their motions. The pelvis supports the vertebral column behind, and is sustained anteriorly by the femoral bones. In the adult, it is situated nearly in the middle part of the body, and is composed of four broad and flat bones, of unequal thickness, and differing much in their form, size, and situation. Of these bones, two are placed behind in the median line, namely, the *Sacrum* and *Coccyx*, two anteriorly and on the sides, namely, the *Iliac* or *Coxal Bones.* The latter correspond to each other on either side, and unite anteriorly by mutual apposition.

OF THE SACRUM.†

371. The *Sacrum (os sacrum*, or *Sacral Bone,)* is symmetrical, pyramidal, triangular, curved forwards below, situated at the posterior part of the pelvis, between the two iliac bones, immediately under the vertebral column, and above the coccyx. It is perforated in its whole length by a canal named the *Sacral*, which is a continuation of the vertebral. It presents the following parts.

372. A *Spinal* or *Posterior Surface.* It is convex, very uneven and rough, and presents, in the median line, four or five compressed horizontal eminences, of which the upper are the longest, and which correspond to the spinous processes of the vertebræ. These eminences are frequently united together, and form a sort of longitudinal ridge. Beneath them, the sacral canal terminates, under the appearance of a triangular channel, closed behind by the posterior sacro-coccygeal ligament, and limited on the sides by two tubercles, which unite above with the last of these eminences, and under which is observed a notch, which transmits the last sacral nerve. These tubercles are named *Horns of the Sacrum.* They sometimes unite with eminences on the base of the coccyx.

373. On the sides of these eminences are observed two broad and superficial channels, which seem to form the continuation of the vertebral channels, and which are covered by the origins of the

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* *Pelvis* is the Latin for a *basin*, to which the upper part of this group of bones has a considerable resemblance. Vesalius and Colombo appear to have been the first anatomists who considered the pelvis by itself, and who assigned it the particular name which it bears.

† The epithet *sacred* (ἵερον) was given by the ancients to a multitude of different parts, and especially to several of those which are subservient to generation.

muscles by which the latter are filled up. These channels are perforated by four holes named the *posterior sacral foramina*, which are placed vertically beneath each other, diminishing in size as they proceed downwards, and are very irregular in their margin. They communicate with the sacral canal, and give passage to the posterior branches of the sacral nerves. To the outside of these holes, there is observed a series of eminences, which seem to be the continuation of the articular processes of the vertebræ; and above them, are seen, on each side, two depressions into which are inserted the sacro-iliac ligaments.

374. A *Pelvic* or *Anterior Surface.* This surface is smooth, concave, traversed by four prominent lines, indicating the union of the different pieces of which the bone is composed in childhood, and separated by superficial, transverse grooves, which seem to correspond to the anterior surface of the bodies of the vertebræ. The highest of these grooves is convex transversely, the next is plane, the others concave. On the lateral parts are the *Anterior Sacral Foramina*, four on each side, larger than the posterior, with which they communicate by the sacral canal, and giving passage to the anterior branches of the sacral nerves. Their form is rounded, and their margin even. To the outside of these holes, which also diminish in size from above downwards, is a surface which gives attachment to the pyramidal muscle, and is marked with some broad grooves, having various directions, the upper transverse, the others becoming more oblique in succession. These grooves terminate in the sacral holes, and are occupied by the nerves which issue from them. This part of the bone appears to be nothing else than an aggregation of pieces corresponding to the transverse processes of the vertebræ.

375. Two *Iliac* or *Lateral Surfaces.* These surfaces, which are very uneven, triangular, broad above and contracted below, present at the upper part an irregular rough space, of an oval form, posteriorly notched, and articulated to a similar surface belonging to the iliac bone. It is directed obliquely backwards, and, with reference to the median line, inwards, and is narrower below than above. The rest of these surfaces is uneven for the attachment of the sacro-sciatic ligaments. At their lowest part, there is observed a small notch for the passage of the fifth pair of sacral nerves.

376. A *Base*, which is directed upwards and a little forwards, and is largest in the transverse diameter. In the middle and anteriorly, it is surmounted by a transverse oval surface, placed obliquely to correspond with the body of the last vertebra, with which it is articulated, and in connection with the last intervertebral cartilage. On its sides is observed a smooth surface, transversely concave, convex from before backwards, inclined forwards, covered by the anterior sacro-iliac ligaments, and continued into the iliac fossa. Behind the articular surface, is observed the orifice of the *Sacral Canal*, of a triangular form, wider behind than before, and giving attachment by its two lateral margins, to the

last of the ligamenta flava. This orifice is limited, on either side, by a concave articular process, directed backwards and inwards, united with that of the last vertebra, detached from the rest of the bone anteriorly and on the sides by a pretty deep groove, which along with the inferior notch of that vertebra, forms the last foramen conjunctivum.

377. A *Summit*, directed downwards and a little backwards, presenting a transverse oval surface, by which it is articulated to the coccyx.

378. *Structure.* The sacrum, although very thick, especially at its upper part, is light and almost entirely spongy. It is besides perforated with a great number of cavities, which are further calculated to diminish its weight. An extremely thin layer of compact tissue invests its surface, and is prolonged into the sacral holes and canal. This canal itself, of which the transverse section is triangular, is curved like the sacrum, a little flattened below, or even open behind to a considerable extent, and diminishes in breadth as it descends. The last prolongation of the encephalic membranes and the sacral nerves fill up its interior.

379. *Articulation* and *Development.* The sacrum is articulated to the fifth lumbar vertebra, the coccyx, and the two iliac bones. Its junction with the spinal column forms a projecting angle named the *Promontory.* Its development is in some measure similar to that of the vertebræ, and takes place by thirty-four or thirty-five points of ossification, disposed as follows: 1st, five, placed above each other, occupy the middle and anterior part; 2dly, in each of the intervals by which they are separated, at a period considerably antecedent to that of birth, two small bony plates are developed, which seem to form their articular surfaces; 3dly, ten are situated anteriorly on the sides of the latter; 4thly, behind them there are developed six others, between which; 5thly, there appear three or four others, which correspond to the spinous processes and their plates; 6thly, there is one on each side, at the upper part of the iliac surface, for the articular face. This latter is developed at a later period, and seems to form a thin plate, which itself sometimes originates by three or four particular centres. It is not uncommon also to find some other points of ossification besides those mentioned; but they are very irregular and inconstant.

On account of the complexity thus exhibited by the development of the sacrum, many anatomists have considered it as formed by the union of five vertebræ placed one above the other, and decreasing from the upper part downwards.

380. The sacrum has a different form in the male from what it has in the female. In the former, it is longer and narrower, and has a smaller curvature. In the latter, on the contrary, it is shorter, broader, and more curved, and presents pretty unvarying dimensions, which it is of importance to know. Thus, in general, it is from four to four and a half inches in length; its breadth, taken at the upper part, is nearly equal to its length, while at the lower,

it is not more than six or seven lines; its thickness, measured from the middle and projecting part of its base to the first tubercle of its posterior surface, is two and a half inches.

OF THE COCCYX.[*]

381. *Form.* The *Coccyx (Coccygeal Bone, Os Coccygis)* is an assemblage of three or four, rarely five small bones, whose size gradually diminishes from above downwards, situated in the median line, connected by interposed cartilages, and seeming as if suspended from the sacrum, to which they form a sort of moveable appendage, and whose curvature they prolong anteriorly. In the adult, these small bony pieces, which are analogous to the vertebræ, although they resemble them less than those of the sacrum, are almost always united, and constitute a symmetrical triangular bone, which corresponds in man to the tail of quadrupeds, and in which the following parts are distinguished.

382. A *Spinal* or *Posterior Surface*, convex, uneven, receiving the insertions of the aponeuroses of the large glutei and posterior sacro-coccygeal ligament.

383. A *Pelvic* or *Anterior Surface*, concave, smooth, invested by the anterior sacro-coccygeal ligament. The rectum lies upon it. Like the posterior surface, it is intersected by transverse grooves, which correspond to the intervals by which the different pieces of the bone were for a long time separated.

384. *Two Lateral Edges*, which are uneven, and give attachment to the anterior sacro-sciatic ligaments and the ischio-coccygeal muscles.

385. A *Base* directed upwards, and presenting anteriorly an oval, concave surface, articulated to the summit of the sacrum, and posteriorly two small tubercular eminences, often continuous with the latter bone, and named the *Horns of the Coccyx.* In almost all cases there are observed upon it two eminences, which are notched for the transmission of the fifth pair of sacral nerves.

386. A tubercular irregular *summit*, sometimes bifurcated or singularly contorted, which gives attachment to the levatores ani.

387. *Structure.* The coccyx is almost entirely spongy. The tissue of which it is composed is commonly softer than that of the other bones. It is invested externally by a very thin plate of compact tissue. Its first piece is proportionally larger than the others, plain before, convex and uneven behind. The second is rounded, and has frequently two small processes behind, analogous to the horns of the first piece. The third, which is still more rounded, is broader above than below. The fourth is tubercular, uneven, and has in many cases a great resemblance to one of the last phalanges of the fingers. The first portion is frequently continuous with the

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[*] Κόκκυξ, *cuculus*, from its being supposed to resemble the beak of a cuckoo.

sacrum, and the fourth always unites at an early period with the third. This union happens much later in the female than in the male.

388. *Articulations* and *Development.* The coccyx, which is articulated solely to the sacrum, commences its development with four or five points of ossification, one for each of its portions. I have, however, sometimes observed three distinct centres in the first piece. Occasionally, also, the second and third pieces are each developed by two lateral bony nuclei. The cartilages, of which it is entirely formed in the fetus, ossify later than those of the sacrum. It is further to be observed, that the coccyx unites with the sacrum earlier in the male than in the female, in whom it is moreover longer and more curved.

OF THE COXAL,[*] ILIAC,[†] OR HAUNCH BONE.

389. *Form.* The *Haunch Bone (os innominatum, os coxarum, os iliacum)* which is a double unsymmetrical bone, of a quadrilateral form, curved upon itself in two different directions, as if it had been twisted, contracted in the middle, and of a very irregular figure, is the largest of all the flat bones, and occupies the lateral and anterior parts of the pelvis. It is divided into the following parts :—

390. *Femoral* or *External Surface.* This surface is at its upper part directed outwards, backwards, and downwards, at its lower part forwards. In its upper and posterior portion, there is observed a narrow, convex, uneven surface, to which is attached the gluteus major. This surface is terminated beneath by a low circular ridge, which is named the *Upper Curved Line*, and surmounts another broader surface, concave behind, and contracted at its fore part, into which is inserted the gluteus medius, and which is in like manner bounded by a ridge named the *Lower Curved Line*, which proceeds from the sciatic notch, to unite with the iliac crest, and receives an aponeurosis belonging to the gluteus medius. A little more downwards is observed the orifice of a canal which transmits vessels to the bone, in the middle of a very large convex surface, which gives insertion to the fibres of the gluteus minor, and which, at its anterior and lower part, presents inequalities, into which the curved tendon of the rectus femoris is inserted. All this portion of the external surface which we have been describing forms a sort of wide fossa, alternately concave and convex, and which some anatomists designate by the name of *External Iliac Fossa.*

391. Downwards and forwards, this surface presents, at its up-

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[*] *Coxæ,* the haunches.

[†] This name is derived from the circumstance that these bones support the parts which the ancients named *Ilia,* that is to say, the flanks.

per part, the *cotyloid cavity,*[*] or *acetabulum,* which is nearly hemispherical, inclines obliquely outwards, forwards, and downwards, and is covered with cartilage, excepting in its bottom, where a rough impression is seen, which is filled by the synovial fringes in the recent state. This cavity has a diameter of about two inches, and is articulated with the head of the femur. It is circumscribed by a margin or edge, very prominent at the upper part and externally, uneven, and interrupted anteriorly by a deep notch for the passage of the vessels which supply the joint, presenting a slight depression behind, and one to the inside and downwards, and lastly, supporting a fibro-cartilaginous brim which increases the depth of the cavity.

392. A little before and beneath the cotyloid cavity, is observed the *Foramen Ovale* or *Obturator Hole,* the largest perforation that exists in the bone. It is of an oval form in the male; triangular, with the angles rounded, and smaller in the female. Its greatest diameter is inclined downwards and outwards. Its circumference, which is thin and uneven, presents at the upper part a groove, passing obliquely from behind forwards and from without inwards, through which pass the obturator vessels and nerve, and gives attachment to a fibrous membrane which closes the hole, excepting at the place of the groove. The edges of the latter cross each other to be continued into the two sides of the circumference.

393. At the inner side of the foramen ovale, is a concave, nearly plane surface, broader above and below than in the middle, to which the adductor muscles of the thigh and the obturator externus are attached. At its outer and posterior side, above the sciatic tuberosity, is observed a superficial groove over which the tendon of the obturator internus muscle slides.

394. *Abdominal* or *Inner Surface.* This surface is at its upper part directed forwards, and at the lower backwards. At the backmost part and above, there are observed a tuberosity which gives attachment to the sacro-iliac ligaments, and a notched oval surface, corresponding to that of the lateral surfaces of the sacrum, with which it is articulated. The rest of the upper part of this surface is occupied by a broad and shallow cavity, named the *Iliac Fossa,* perforated in its middle by a vascular canal, and filled by the iliac muscle. It is limited below by a concave, broad, and rounded prominent line, which forms a portion of the upper strait of the pelvis. Beneath this line are observed, a smooth, inclined, nearly plane surface, covered by the obturator internus and levator ani muscles; the inner orifice of the obturator hole and its groove; and lastly, a second surface, narrower above than below, which corresponds to the bladder.

395. *Upper Edge,* or *Iliac Crest.* Thick, uneven, convex, in-

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[*] Κότυλος, *a certain kind of cup.*

clined outwards, excepting posteriorly where it is directed a little inwards, twisted upon itself like an italic *s*, thinner in the middle than at the extremities, and longer in the female than in the male; this edge gives attachment externally to the obliquus externus abdominis and latissimus dorsi, as well as to the crural aponeurosis; internally, to the transversalis abdominis and quadratus lumborum; and in the intermediate portion, to the obliquus internus abdominis. In an adult woman it is six inches in extent, when measured directly, and eight inches when its turnings are followed.

396. *Lower Edge.* This edge, which is shorter than the others, and inclined inwards, presents below a thin crest, more oblique and blunter in the female, bent outwards, forming one of the sides of the pubic arch, giving attachment, externally, to the gracilis and adductors of the thigh, and internally to the corpus cavernosum, and the transversus perinœi, and erector penis.

This crest is surmounted anteriorly by a vertical surface, of an elliptical form, which unites with the bone of the opposite side to form the symphysis of the pubes.

397. *Posterior Edge.* Its form is very irregular. It is oblique from above downwards, and from without inwards. At its union with the upper edge, it forms the *Posterior and Superior Iliac Spine*, a large projecting eminence, which is separated by a small notch, from another smaller eminence, named the *Posterior and Inferior Iliac Spine.* The latter is rounded, sharp, and formed by the posterior part of the surface which articulates with the sacrum. Beneath this process, there occurs a very deep notch, which contributes to form the *Great Sciatic Hole (foramen magnum sciaticum)*, and which is terminated below by a thin, pointed, triangular, and compressed eminence, named the *Sciatic Spine.* This spine, which is more or less prominent in different individuals, gives attachment externally to the superior gemellus, internally to the coccygeus, and by its summit to the anterior sacro-sciatic ligament. Beneath it are observed a notch, pretty frequently channelled, in which is reflected the tendon of the internal obturator muscle, and the *Sciatic Tuberosity.* This latter eminence, which is broad and rounded, is formed by the union of the posterior and inferior edges of the iliac bone. The quadratus and adductor magnus femoris, are inserted into its outer part; the inferior gemellus and sacro-sciatic ligament into the inner; the biceps, semi-tendinosus and semi-membranosus into the middle.

398. *Anterior Edge.* This edge is concave, oblique above, and nearly horizontal below. By uniting with the upper edge, it forms the *Anterior and Superior Iliac Spine*, into which are inserted, externally the tensor vaginæ femoris, internally the iliac muscle, and in the middle the obliquus externus abdominis and sartorius. A notch giving passage to some small nerves, separates this eminence from the *Anterior and Inferior Iliac Spine*, to which is attached one of the tendons of the rectus femoris. The tendon of the psoas and iliacus muscles slides over a groove which is observed

farther down, and which is limited internally by the *Ilio-pectineal Eminence*, into which the psoas minor is inserted. The edge of which we are speaking is terminated by a triangular horizontal surface, directed slightly downwards and forwards, broader externally than on the inner side, receiving the fibres of the pectineus muscle by its posterior edge, which is thin and uneven, and which forms part of the superior sinus of the pelvis, and continued by the anterior edge into one of the lips of the sub-pubic channel. The *spine of the pubes*, to which are attached the pyramidal muscle and the outer pillar of the inguinal ring, occupies the summit of this surface near the union of the anterior edge with the lower.

399. *Structure*. The iliac bone is in general thick. Its cellular tissue presents large inflated areolæ, having the appearance of lace. Two layers of compact tissue, the one external, the other internal, cover it in its whole extent, and touch each other in the centre of the iliac fossæ, where the bone is thin and transparent. The bottom of the cotyloid cavity is also very thin.

400. *Development*. Several years after birth an osseous plate is seen to develope itself upon the upper edge of the bone, to form the iliac crest; while a similar plate embraces the sciatic tuberosity, and extends over the branch of the ischium. A third plate at the same time occupies the anterior and inferior tubercle of the ilium, and is more regular in its appearance in the male than in the female. Lastly, a fourth, which is less frequently observed in the male, is formed in the angle of the pubes. But in the fetus, long before this period, three principal centres of ossification are developed at once in the iliac fossa, at the sciatic tuberosity, and near the spine of the pubes. These three points of ossification unite their fibres in the cotyloid cavity. Nor must we forget to mention, that in certain subjects, especially in females, a particular epiphysis constitutes the spine of the pubes, and forms a small lamina, which occasionally remains moveable on the body of the bone, so that it might be considered as the rudiment of the marsupial bone which exists in many animals. This opinion was that of Beclard, and I perfectly agree with him.

401. In consequence of this mode of development, the iliac bone has been divided into three portions, the *Ilium*,[*] *Pubes*,[†] and *Ischium*.[‡] The *ilium* is the uppermost, and forms the margin and prominence of the haunch. The *pubes* constitutes the anterior part of the bone, and sustains the external organs of generation. The *ischium* is the lower portion, and is that which supports the body when it is seated. But although these three regions are distinct in various respects, they must not be considered as constituting so many particular bones. We have also to observe, that the upper

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[*] Probably so named because it seems to support the intestine called the *Ileon*.

[†] So named on account of the vicinity of the parts which are developed at puberty.

[‡] Ἰσχιον, *coxa, seu acetabulum*.

and horizontal portion of the pubes has received the name of the *Body* of that bone, while the lower portion is termed the *Branch* or *Ramus:* as to the ischium, it is its posterior part which forms the *Body*, and the anterior the *Ramus*.

402. *Articulations.* The iliac bone is articulated to the sacrum, the other iliac bone, and the femur.

403. *Uses.* This bone forms the solid part of the haunch. It protects the viscera contained in the small or lower pelvis, sustains the abdominal viscera in part, and affords attachment to a great number of ligaments and muscles, belonging to the abdomen and thigh.*

OF THE PELVIS IN GENERAL.

1. OF THE CONFORMATION OF THE PELVIS.

External Surface.

404. *Anteriorly*, this surface, which is inclined downwards, presents, in the middle where it is covered solely by cellular tissue, and by the skin of the pubic region, the junction of the two ossa pubis, which come into contact by a larger surface in the male than in the female; and on the sides, where it is broader, the rugosities into which the adductor muscles are fixed, the obturator holes, and the cotyloid cavities. The latter are placed at a greater distance from each other in the female than in the male.

Posteriorly the pelvis is longer but narrower than before, and is convex from above downwards, and transversely concave in the middle. There are observed upon it, in the median line, the posterior tubercles of the sacrum, the end of the sacral canal, the union of the sacrum with the coccyx, and the posterior surface of the latter bone. On each side, there occur the posterior sacral foramina, the insertions of the sacro-iliac ligaments, a broad and deep groove, extending vertically between the sacrum and iliac bone, and lastly, the posterior iliac spines.

On the Sides, are the external iliac fossæ, the curved lines to which the glutæi muscles are attached, the edge of the cotyloid cavity, and at the lower part, the great sciatic notches. In the whole extent of its lateral regions, the pelvis is separated from the skin by thick muscles.

Internal Surface.

405. The internal surface of the pelvis is divided into two distinct parts, by a prominent rounded line which circumscribes a tri-

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* Mr. Cloquet has omitted the principal use of the pelvis; as a powerful bony girdle it affords a solid articulation for the lower extremities; when these extremities are wanting, as in some animals, (*the cetacea*) the bones of the pelvis are mere rudiments, and have no proper articulation with the spinal column. K.

angular curvilinear space, the angles of which are very rounded, and whose base corresponds to the sacrum. This line is named the *Brim* or *Margin* of the pelvis, while the space which it embraces is called the *Upper* or *Abdominal Strait*, or the *Entrance of the Excavation of the Pelvis.* Proceeding from the junction of the sacrum with the last vertebra, this line passes over the ilium and is prolonged upon the pubes. It is much more distinct posteriorly and on the sides than before. The abdominal strait has the form of an ellipse, whose greatest axis is transverse, and whose circumference is interrupted posteriorly by the projection of the promontory. Its capacity is measured by four diameters, whose dimensions are greater in the female than in the male, and which are as follows: 1st, the *antero-posterior* or *sacro-pubic*, extending from the upper edge of the sacrum to the inner surface of the junction of the pubes, which is the smallest; 2dly, the *transverse* or *iliac*, from one side of the pelvis to the other, intersecting the preceding at right angles, and which is the largest; 3dly, two *oblique*, measured from the cotyloid wall of one side to the union of the sacrum with the iliac bones on the other, and which are intermediate in size.

406. Above the upper strait, is seen the *Great Pelvis*, a sort of cavity which leads into the pelvis properly so called, or that expansion which constitutes the haunches, in which are observed, posteriorly, the *Sacro-vertebral Angle;* on the sides, the iliac fossæ; and, anteriorly, a large notch, filled up by the broad muscles of the abdomen.

407. Beneath this strait is the *Small Pelvis* or *Pelvic Excavation*, remarkable for its capacity, which is somewhat greater than that of the strait itself; for the disposition of its walls, which all form smooth planes, inclined toward the lower aperture of the pelvis; and for its length, which is greater than that of the upper pelvis, although its breadth is much smaller. It seems to constitute a sort of curved canal, dilated in the middle and contracted at its upper and lower extremities. Posteriorly, where it is concave from above downwards and directed downwards, it presents the concave surfaces of the sacrum and coccyx; anteriorly, where it is transversely concave and directed upwards, the posterior parts of the junction of the pubes, two surfaces which correspond to the bladder, and the two obturator holes; and, on the sides, the great sciatic notches and a portion of the articulation of the sacrum and iliac bone.

UPPER CIRCUMFERENCE, OR BASE OF THE PELVIS.

408. It is inclined upwards and forwards, is very uneven, and is wider in the female than the male. It presents laterally the two iliac crests; posteriorly, the sacro-vertebral angle, on the sides of which are two depressions filled by the muscles of the loins, and in

which is seen the upper part of the sacro-iliac articulation; anteriorly, the anterior iliac spines, the channel which lodges the united mass of the iliacus and psoas muscles, the ilio-pectineal eminence, the spine of the pubes, the upper part of the symphysis pubis, and lastly, the great notch of which we have already spoken, and which is formed by the anterior edges of the ossa ilii.

LOWER CIRCUMFERENCE, OR LOWER STRAIT OF THE PELVIS.

409. This strait, which is also named the *perineal*, is circumscribed anteriorly by the junction of the pubes, on the sides by the branches which proceed from thence to the sciatic tuberosity, and behind by the extremity of the sacrum and coccyx. It is directed downwards and a little backwards. Its form is irregular and difficult to be determined, because its edges are notched and inclined in two different directions. It seems, in fact, to result from the union of three large eminences, separated by an equal number of deep notches. The sciatic tuberosities form the two anterior eminences, which are placed wider asunder in the female than in the male, and which descend lower than the posterior and middle eminence, which is represented by the coccyx. One of the notches is placed before, and is named the *Pubic Arch*, or *Arch of the Pubes.* It is formed on each side by the bony plate which occurs beneath the sub-pubic hole, and terminated above by an angle, nearly acute in the male, but very rounded in the female, which is occupied by the genital organs in both sexes; and is surmounted by the junction of the pubes. The two other notches are situated behind, between the sciatic tuberosity and the sacrum. They are named the *Sciatic Notches*, and are each divided, in the recent state, into three portions by the sacro-sciatic ligaments, and traversed by the pyramidalis, the sciatic, glutæal and pudic vessels and nerves, the tendon of the obturator internus, &c.

410. Here, as in the abdominal strait, there are observed four diameters. The *antero-posterior, or coccy-pubic*, which is the largest, is measured from the summit of the coccyx to the symphysis of the pubes. The *transverse*, is smaller, and extends from one tuberosity of the ischium to the other. The *oblique* diameters, are limited by the tuberosity of the ischium on the one hand, and on the other by the middle of the opposite posterior sacro-sciatic ligament; on which account, these oblique diameters cannot be measured on an artificial skeleton.

2. OF THE DIRECTION OF THE PELVIS.

411. The pelvis is not placed in a horizontal plane, but represents a conoid compressed before and behind, and having its two extremities cut obliquely, so as to be always more or less inclined

forwards. Thus, in the standing posture, a line drawn horizontally backwards from the upper edge of the pubes, falls nearly upon the middle of the sacrum. In the ordinary state, the inclination of the abdominal strait comes in consequence to be 35°; but it varies according to the attitude assumed.

412. With respect to the lines which are drawn transversely from one part of the pelvis to that which corresponds to it on the other side, they are always horizontal; these parts being placed at the same level, on account of the symmetry of this portion of the trunk.

413. From the circumstance that the two straits of the pelvis have not the same inclination, each of them has necessarily a different axis; that of the abdominal strait, passing through the centre of the space it circumscribes, would fall upon the lower third of the sacrum, while the axis of the perineal strait would pass from its centre to the sacro-vertebral angle, and meet the former about the middle of the pelvic excavation, forming with it an obtuse angle opening anteriorly. Moreover, the axis of the great pelvis is nearly vertical, while that of the excavation is sensibly oblique from above downwards, and from before backwards. It will be guessed that this determination of the axis of the pelvis is not given here with mathematical precision; but, such as it is, it is of much importance to the accoucheur to know it.

3. DIMENSIONS AND PROPORTIONS OF THE PELVIS IN THE WELL-FORMED FEMALE.

414. *Dimensions of the Great Pelvis.*

1. From one superior and anterior iliac spine to the other, 10.023 inches.
2. From the middle of one iliac crest to the corresponding point of the opposite side, 11.076 inches.
3. From the middle of the iliac crest to the edge of the abdominal strait, 3.510 inches.
4. From the middle of the iliac crest to the sciatic tuberosity, 7.410 inches.

415. *Dimensions of the Abdominal Strait.*

1. Sacro-pubic diameter, 4.290 inches.
2. Iliac diameter, 5.460 inches.
3. Oblique diameters, 4.680 inches.
4. Circumference, 14.820 inches.

416. *Dimensions of the Perineal Strait.*

1. Diameter from the coccyx to the pelvis, on account of the mobility of the former bone, from 4.290 to 5 inches.

2. Transverse diameter, 4.290 inches.
3 Oblique diameters, 4.290 inches.
4. Summit of the arch of the pubes in breadth, 1.170 inches.
5. Base of the arch of the pubes, or the distance between its branches, 3.705.

417. *Dimensions of the Pelvic Excavation.*

1. Height of the posterior wall, 4.836 inches.
2. Height of the anterior wall, 1.560 inches.
3. Height of the lateral walls, 3.705 inches.
4. Thickness of the symphysis pubis, .546 inch.
5. Depth of the cavity of the sacrum, .702 inch.
6. Length of the coccyx, .975 inch.
7. Length of the concavity of the sacrum, beneath the arch of the pubes, 4.875 inches.*

418. We have given the dimensions of the pelvis in an article by itself, that they may thus be more easily compared, for the purpose of deducing useful corollaries from them.

The measurements in question we have indicated only in the female, because in the male, although the pelvis presents nearly the same general conformation, it no longer presents the same dimensions. As it is of no practical utility† to become intimately acquainted with the measurements of the male pelvis, we shall not much insist on the differences that exist between it and the female. It is in fact sufficient for us to know, that the pelvis of the female has a greater capacity than that of the male; that its surfaces are smoother, its contours less rugged, the attachments of the muscles less marked. In her, the haunches are more prominent and more rounded, because the upper part of the iliac bones is thrown more outward; the iliac crest and spines are thinner, and less rough; the sacro-vertebral angle projects less; the contour of the abdominal strait is wider and more rounded; the sacrum is broader, as well as the pubic arch, of which the branches are less thick, and directed outwards; the sciatic tuberosities, which are smaller, have also this direction; the junction of the pubes is not so high; and the cotyloid cavities are more remote from the centre of the body, which produces a difference in the mode of running.

But although the pelvis of the female is broader than that of the male, it is not nearly so high. In the latter, the bones are thicker, the muscular impression more distinct, the articular surfaces broader. Every thing, as Verrheien has remarked, seems to impress the idea of strength; while, in the female pelvis, every thing seems to indicate its adaptation to childbirth.

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* Chaussier. *Tab. Synopt. des Accouchem.*, folio, Paris.

† Notwithstanding this observation of Mr. Cloquet, it may still be useful to remind the surgeon, that the male pelvis may be deformed; that the tuberosities of the ischium will be found much nearer each other in certain male subjects than in others; that the ramus of the pubes and of the ischium may be found quite straight, or almost perpendicular on one side, (generally the left,) whilst on the other side, it will arch widely outwards. It is sufficiently curious also to observe, that this mal-conformation of the male pelvis occurs in skeletons which present not the smallest deformity in any of the other bones. K.

419. The stature has no decided influence upon the dimensions of the pelvis, and the differences existing in individuals are independent of it. It is well known that little women are delivered with as much ease as tall women, and bring forth children quite as large as theirs.

VI.—OF THE TRUNK IN GENERAL.

420. We have already seen that the head bears a certain resemblance to the vertebræ, and possesses all their parts. The two other portions of the trunk, the thorax and pelvis, present a similar analogy. Thus the ribs appear to be nothing but transverse processes prolonged in an extreme degree; the sacrum and coccyx seem to be the continuation of the body and spinous and articular processes of the vertebræ, of which the iliac bones would also represent the transverse processes, highly developed, on account of certain particular purposes for which they are intended. This assimilation becomes still more evident when it is known that the muscles which are inserted into it are entirely analogous to those attached to the vertebræ,* differing merely as to form and length.

421. Between the head and chest, the trunk presents an empty space, the length of which is determined by that of the cervical region of the spine. This space is occupied by the *Throat.* Another empty space occurs between the base of the chest and that of the pelvis, which is filled up by the *Abdomen;* this space, however, is much larger than the first.

422. All the regions of the trunk are not of equal breadth. It is observed that, in the female, its broadest part is the pelvis; in man, the broadest part is at the base of the thorax. In both sexes, the head is the narrowest region of the body; but in very young children, its dimensions are larger than those of the thorax and pelvis

VII.—OF THE EXTREMITIES OR LIMBS.

423. The *Extremities* or *Limbs* are appendages of the trunk, four in number, disposed symmetrically in pairs, inserted into it by one of the extremities, and composed of a series of bones representing contiguous levers, all shaped obliquely at their extremities.

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* Dumeril, loc. cit.

OF THE SUPERIOR OR THORACIC EXTREMITIES.

1. OF THE BONES OF THE SHOULDER.

424. The *Shoulder*, which is situated on the upper, lateral and posterior parts of the chest, connects the thoracic extremities to the trunk, and forms the centre of their great motions. It consists of two bones, the *Scapula* and *Clavicle.*

OF THE SCAPULA.

425. *Form.* The *Scapula* or *Shoulder-blade* is an irregular bone, situated at the posterior and upper part of the thorax, from about the seventh rib to the first, forming the posterior part of the shoulder, and loosely connected, by means of muscles, with the head, the ribs, and the spine. It has a triangular form, is flat and thin over the greater part of its extent, and is divided into the following parts.

426. *Posterior* or *Dorsal Surface.* It is divided transversely into two parts by a depressed, triangular eminence, situated about its upper third, and named the *Spine of the Scapula.* This spine is limited posteriorly by a long, uneven, rough and undulated margin, and projects downwards at its commencement, where it is broad and thick. Near the inner edge of the scapula, it presents a smooth and polished triangular space, on which the aponeurosis of the trapezius slides. In the rest of its extent, it affords attachment at its upper and middle parts to the trapezius, and below to the deltoides. Externally, the spine of the scapula is terminated by a thick and short concave edge, which by its union with the former gives rise to a considerable eminence named the *Acromion.** This process is flattened in a direction contrary to that of the spine, of which it is the termination, and which contracts a little before producing it. Its *outer surface*, which is directed upwards and backwards, is convex and uneven, and is covered by the skin. The *inner surface* is smooth and convex, and inclines downwards and forwards. Its *upper edge*, which is directed forwards, gives attachment to the trapezius, and presents anteriorly a small oval surface, covered with cartilage, with which the outer extremity of the clavicle is connected. The *lower edge* is uneven, and gives attachment to some fibres of the deltoid muscle. Lastly, its summit, which is rounded, affords insertion to the acromio-coracoid ligament.

427. Above the spine of the scapula is observed a slightly concave surface, broad internally, narrow to the outside, filled by the the supra-spinatus muscle, which attaches itself to its two inner thirds. This surface is named the *Fossa Supra-spinalis.*

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* ’Ακρώμιον, *summa scapula.* ’Ακρος, *summus* ; ὦμος *scapula.*

428. Under the spine is the *Fossa Infra-spinalis*, which is much larger than the preceding, a little rounded in the middle, but pretty concave outwards. There is observed upon it a longitudinal ridge, which gives insertion to an aponeurosis common to the infra-spinatus and teres major and minor muscles. Between this ridge and the axillary edge of the scapula is an elongated surface, broader below than above, divided into two parts by another ridge, which descends from that edge and joins the preceding at an acute angle. The upper and narrow portion of this surface gives attachment to the teres minor; the lower, to the teres major. Lastly, the whole infra-spinal fossa is filled by the infra-spinatus muscle, which is inserted into its three inner fourths.

429. *Anterior* or *Costal Surface.* This surface is inclined inwards, and is concave for the purpose of lying upon the ribs, forming what is called the *Sub-scapular Fossa.* It is divided by more or less prominent ridges, running obliquely from above downwards, and from without inwards, into several broad and superficial grooves, occupied by fasciculi of the sub-scapularis muscle, which is inserted into the inner two-thirds of their extent, and attaches its aponeuroses to the ridges mentioned. Behind the subscapular fossa, are observed, above and below, two plane surfaces to which the serratus magnus is attached.

430. *Upper* or *Cervical Edge.* This edge is thinner and shorter than any of the others. Posteriorly, it gives attachment to the supra-spinatus muscle; anteriorly, to the sub-scapularis; in the interval, to the omo-hyoideus. Externally, it presents a notch converted into a hole by a ligament, and giving passage to the supra-scapular nerve, which is sometimes accompanied by the vessels of the same name. Lastly, it is terminated, anteriorly to this notch, by a narrow elongated eminence, curved upon itself, having always more breadth than thickness, at first passing from below upwards, and presently directing itself from behind forwards, and from above downwards. This is the *Coracoid* Process.* The *upper surface* of this process is convex and uneven, and gives attachment to the coraco-clavicŭlar ligaments. The *lower surface* is smooth and concave. The pectoralis minor is inserted into its *anterior edge*, the acromio-coracoid ligament into the *posterior;* while the biceps and coraco-brachialis are attached to its summit.

431. *Posterior* or *Vertebral Edge.* This edge, which is also named the *Base of the Scapula*, approaches the vertebral column above, from which it retires at the lower part. At the distance of a fourth of its length from the upper part, there is observed a very blunt angle, which corresponds to the commencement of the spine of the scapula. This edge itself gives attachment posteriorly to the supra-spinatus and infra-spinatus, anteriorly to the serratus magnus, and in the middle to the rhomboideus. At its union with the upper edge, it forms an acute angle, approaching to a right angle,

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* Κόραξ, *corvus;* εἶδος, *figura;* that is to say of the *shape of the beak of a crow.*

which is embraced by the levator anguli scapulæ, and which is named the *Posterior* or *Cervical Angle.*

432. *Outer* or *Axillary*[*] *Edge,* named also the *Costa.* It inclines downwards and forwards, and is much thicker than the others. At its upper part, it is marked with a sort of groove into which the long portion of the triceps extensor cubiti is inserted. Posteriorly, it presents rugosities into which is inserted the teres minor. Anteriorly, where it is rounded, it furnishes points of insertion to the sub-scapularis. At its lower part, it receives the teres major; and by uniting with the posterior edge, forms an angle named the *Inferior* or *Costal,* which is thick and rounded, and gives insertion to the teres major and some fibres of the latissimus dorsi.

433. The axillary edge of the scapula is surmounted by a thick truncated angle, in which is formed an articular cavity named the *Glenoid.*[†] This cavity, which is superficial, is of an oval form, broader below than above; its great diameter is vertical, and a little inclined downwards and outwards. It is covered with cartilage, and is articulated with the head of the humerus. Its circumference, like that of the cotyloid cavity, is surrounded by a fibro-cartilaginous rim. At its upper part, it gives attachment to the long portion of the biceps muscle. It is supported by a contracted part, named the *Neck of the Scapula,* which is more distinct posteriorly and downwards than in the other directions, and gives attachment to the fibrous capsule of the articulation of the humerus.

434. *Structure.* The scapula is cellular at its angles, and more especially in the substance of the spine, acromion, coracoid process, and glenoid cavity. In the middle of the supra and infraspinal fossæ, it is entirely compact, thin and transparent. There are pretty regularly observed in it two distinct vascular holes on the upper and under surfaces of the spine. Some holes of this kind are also seen in all the places where there is cellular tissue, and around the neck.

435. *Development.* Its development takes place by six or seven points of ossification: 1. one for the body of the bone, which commences at its centre; 2. one for the glenoid cavity; 3. one for the summit of the coracoid process; 4. one for the upper surface and summit of the acromion; 5. one for the dorsal edge; 6. one for the posterior edge of the spine; 7. frequently one for the lower angle.

436. The scapula is articulated to the clavicle and humerus.

OF THE CLAVICLE.[‡]

437. The *Clavicle* or *Collar Bone,* is a long irregular bone, placed, on each side and nearly transversely, at the upper and fore

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[*] *Axillary,* belonging to the *Axilla,* or arm-pit.

[†] Γλήνη, *cavitas haud profunda;* εἶδος, *forma.*

[‡] *Clavicula,* a key. Κλεὶς, *clavis.*

part of the thorax, between the sternum and acromion, so as to cross obliquely the direction of the first rib. It is twisted in the form of an Italic *S*, somewhat in the manner of the keys used by the ancients; less curved and longer in the female than in the male; prismatic and triangular, or irregularly rounded in its two inner thirds, contracted in the middle, broad and flat at the outer part. It is divided into the following parts.

438. *Body* or *Middle Part.* Its *upper surface* is broader toward the outer part than at the inner, where it is rounded, and gives attachment to the sterno-cleido-mastoideus muscle. The *lower surface* presents the same disposition, and is uneven. There are observed upon it, at its inner part, rugosities for the insertion of the costo-clavicular ligament, and at the middle a longitudinal groove, where the hole is observed that gives passage to the vessels which nourish the bone, and which receives the fibres of the subclavius muscle. At its outermost part there is a prominent ridge, running obliquely backwards and outwards, to which are attached the coraco-clavicular ligaments. Its *anterior edge* is broad and convex in its inner half, where the pectoralis major is inserted, narrow and concave in its outer half, to which the deltoid muscle is affixed. Its *posterior edge*, which is thick, concave, smooth, and rounded internally, gives attachment externally, where it is uneven and convex, to the trapezius.

439. *Sternal* or *Anterior Extremity.* This extremity is inclined downwards and forwards, and is considerably thicker than the rest of the bone. There is observed upon it a triangular, broad, uneven surface, convex from above downwards, concave from behind forwards, and covered with cartilage, to be articulated with a narrower surface, which we have already mentioned as occurring at the upper extremity of the sacrum. Ligaments are attached all round its margin, and its lower and posterior angle is much more prominent than the others.

440. *Acromial* or *Posterior Extremity.* It is more raised than the preceding, rests upon the coracoid process, and inclines backwards and upwards. It is articulated to the acromion by a narrow surface, oblong from behind forwards, inclined obliquely from above downwards, and from without inwards, and covered with cartilage. Like the preceding, it is perforated with numerous small vascular apertures.

441. *Structure.* The body of the clavicle is composed of a thick layer of compact tissue externally, and of a spongy tissue with large areolæ internally; but no traces of a medullary canal are perceived in it, as in the other long bones, unless occasionally in extreme old age. The extremities are principally formed of cellular tissue, and covered by a thin plate of compact tissue. The canal of the nutritive vessels is very narrow.

442. *Development* and *Articulations.* The clavicle, which makes its appearance at a very early period in the fetus, commences its development by a single point of ossification for the body; but

at a more advanced period, when that part has nearly acquired its full size, there is formed at each extremity an osseous crust, which ultimately unites with the rest of the bone. It is articulated to the sternum and scapula.

2. OF THE ARM.

OF THE HUMERUS.

443. Form. The *Humerus (Os Humeri, Os Brachii)* is the longest and largest bone of the thoracic extremities. It appears as if suspended to the shoulder, and terminates at the elbow. It is irregular and of a cylindrical form. Its divisions are the following:

444. *Body* or *Middle Part.* From being nearly cylindrical at the upper part, it becomes triangular, prismatic and flattened before and behind at the lower. It appears as if twisted upon itself in its middle region. Its *posterior surface* is rounded above, and turned a little inwards, while below it looks outwards, and is broad and flattened. In its whole extent, it is covered by the triceps extensor, to which it furnishes many points of attachment.

Its *inner surface* is narrower than the outer. At its upper part, there is observed a longitudinal depression, covered with cartilage in the recent state, deep above, and gradually losing itself as it descends. It is the *groove of the biceps,* in which the tendon of the long portion of that muscle slides. It gives insertion, by its posterior edge, to the united tendon of the latissimus dorsi and teres major. The inner surface of the humerus presents, in its middle part, the medullary foramen, which is directed from above downwards, together with some inequalities to which the coraco-brachialis is attached. At its lower part it is rounded, inclines a little forward, and gives insertion to the brachialis internus muscle.

Its *outer surface* is also covered by this muscle at its lower part; but, near its upper third, it presents the *Deltoid Impression,* a sort of scabrous surface into which the deltoid muscle is inserted, and which surmounts a broad and superficial depression, inclined obliquely from above downwards and from behind forwards, which marks the passage of the radial nerve, and one of the principal branches of the humeral artery.

445. These three surfaces are separated from each other by three prominent lines. The *outer,* which is not very distinct at its upper part, where it gives attachment to the triceps extensor, is traversed in the middle by the groove of the radial nerve, and becomes very prominent and a little curved forwards at the lower part, where it affords insertion to the brachialis internus, supinator longus, extensor carpi radialis longior, triceps extensor, and an intermuscular aponeurosis.

446. The *inner prominent line* is also rather indistinct above,

where the triceps extensor is attached to it. The coraco-brachialis is inserted into its middle part; and the triceps and brachialis internus, together with an intermuscular aponeurosis are attached to it below.

447. The *anterior line* approaches very near the preceding at its upper part, and there forms the anterior edge of the bicipital groove, to which the tendon of the pectoralis major is attached. In the middle it is interrupted by the impression of the deltoid muscle, and becomes rounded and broadened below, to give insertion to the brachialis internus.

448. *Upper* or *Scapular Extremity.* This is the largest part of the bone, and is formed by three eminences. The upper, which is inclined inwards and backwards, of a nearly hemispherical form, smooth, and covered with cartilage, is named the *Head of the Humerus*, and is articulated with the glenoid cavity of the scapula. It is supported by a *Neck*, or contracted part, a little longer and more distinct forwards, downwards, and inwards, than at its upper and outer part, where it resembles a mere groove. The axis of this neck is placed obliquely to that of the bone, and forms an obtuse angle with it. The other two eminences are named the *Greater* and *Smaller Tuberosities.* The first, which is situated posteriorly, is rounded, and presents three plane surfaces, of which the anterior receives the tendon of the supra-spinatus muscle, the middle that of the infra-spinatus, and the posterior that of the teres minor ~~major~~. The other, which is much narrower, but a little more prominent, gives attachment to the tendon of the sub-scapularis. These two tuberosities are separated from each other by the commencement of the bicipital groove, which is directed downwards and inwards.

449. *Lower* or *Anti-brachial Extremity.* This end of the bone is flattened and curved forwards. Its transverse diameter is the greatest. At the outside, it presents an eminence, named the *External Condyle*, into which is inserted the external ligament of the elbow joint, together with the extensor carpi radialis brevior, extensor communis digitorum, extensor proprius minimi digiti, extensor carpi ulnaris, anconeus, and supinator brevis. Internally, there is observed another eminence or tuberosity, the *Internal Condyle*, more prominent and higher than the preceding, which is turned a little backwards, and receives a tendon common to the pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris, and superficial flexor muscles, together with the internal lateral ligament of the joint. Between these two eminences is an articular surface, turned forwards, descending beneath them, and formed from without inwards, 1st, by the *Small Head of the Humerus*, a rounded eminence, which is received into the cavity of the upper extremity of the radius; 2dly, by a groove which corresponds to the margin of that cavity; 3dly, by a semicircular sharp crest, which is lodged between the cubitus and radius; 4thly, by a pulley situated beneath the level of the small head, and articulating with the large sigmoid cavity of the cubitus.

It is on account of the greater projection of this pulley that the humerus inclines outwards, when it is placed by its lower extremity on a horizontal plane. At the fore part of this extremity, and above the articular surface, is a superficial cavity which lodges the coronoid process of the cubitus when the fore arm is bent; and at the back part, is observed a deeper fossa, which receives the olecranon when the fore arm is extended. Lastly, above the small head, is a depression, into which the edge of the upper cavity of the radius is received during the forced flexion of the joint.

450. *Structure*, *Articulations*, and *Development*. The humerus is compact in its body, spongy and cellular at the extremities, and contains a large medullary canal. It is articulated to the scapula, the radius, and the ulna; and is developed by eight points of ossification, one for the body, one for the head, one for the large tuberosity, one for the small tuberosity, one for the pulley of the lower extremity, one for each of the condyles, and one commonly for the small head.

3. OF THE BONES OF THE FORE ARM.

OF THE RADIUS.

451. The *Radius*, which is situated nearly vertically at the outer part of the fore-arm, is a little shorter than the ulna. It is smaller above than at its lower part, and is slightly curved inwards about the middle. It is divided as follows.

452. *Body* or *Middle Part*. It is prismatic, and trigonal. Its *anterior surface* becomes gradually broader as it descends, is plain in the greater part of its extent, and about a third from the upper extremity presents the orifice of the canal by which the vessels pass into the bone, and which is directed upwards. The three upper fourths of this surface give attachment to the flexor longus pollicis manus, and its lower fourth to the pronator quadratus. Its *posterior surface* is convex in its upper third, which is covered by the supinator brevis. In the middle it is slightly concave, and receives the insertions of the extensors of the thumb. At the lower part it is convex, and is covered by the extensor communis digitorum, extensor proprius indicis, and extensor longus pollicis. The *outer surface*, which is rounded and convex in its whole extent, gives attachment at its upper part to the supinator brevis; in the middle, where a rough impression is observed, to the pronator teres; and, at its lower part, is covered by the tendons of the radial extensors of the carpus.

453. These three surfaces are separated by an equal number of prominent edges, of which the *posterior* is rather indistinct at its upper and lower parts, although pretty obvious at the middle. The *inner*, which is very distinct, thin, and sharp, and somewhat arched in the middle, gives attachment to the interosseous ligament.

The *anterior* is less prominent. It is rounded, especially at its lower part, sometimes presents the aperture for the vessels of the bone, and at its upper part affords insertion to the flexor sublimis, flexor longus proprius pollicis, and supinator brevis; while at its lower part, it receives first the pronator quadratus, and afterwards the supinator longus.

454. *Upper* or *Humeral Extremity.* It presents at its upper part a superficial circular cavity, covered with cartilage, into which is received the small head of the humerus. The circumference of this cavity, which is also smooth, and covered with a cartilaginous layer, is broader internally, where it is articulated with the small sigmoid cavity of the ulna. In the rest of its extent, it is connected with the annular ligament. This articular part of the radius is supported by a round contracted *Neck*, about a finger's breadth in length, and inclined a little outwards. This neck terminates downwards and inwards at the *bicipital tuberosity*, an eminence which is smooth and contiguous externally with the tendon of the biceps flexor, to which it affords attachment internally by a rough surface.

455. *Lower* or *Carpal Extremity.* It is nearly square and larger than the upper. There is observed at its lower part an articular surface, which is traversed from before backwards by a somewhat indistinct line, and is connected externally with the os scaphoides, and internally with the semilunar bone, for which purpose it presents two surfaces, of which the outer is triangular, and of greater extent, the inner square, and less elongated. Anteriorly, this extremity of the bone gives attachment to the anterior ligament of the wrist joint. Posteriorly, it presents two vertical grooves, of which the outer is narrow, passes a little obliquely outwards, and contains the tendon of the extensor longus pollicis, while the inner, which is broader and superficial, affords a passage to the tendons of the extensor communis digitorum and extensor indicis. Internally, it presents an oblong cartilaginous cavity, which is articulated to the lower extremity of the ulna; and on the outside is marked with two other grooves, the anterior for the tendons of the extensor ossis metacarpi pollicis and extensor primi internodii pollicis, the posterior for the tendons of the radial extensor muscles. The edge by which these grooves are separated terminates below in a pyramidal eminence, named the *styloid process* of the radius, which is itself terminated by a blunt summit, into which the external lateral ligament of the wrist joint is inserted.

456. *Structure*, *Articulations* and *Development.* The radius presents exactly the same structure as the humerus and all the long bones. It contains a medullary canal, which is more distinct and wider above than below. It is articulated with the humerus and ulna, and the scaphoid and semilunar bones. It is developed by three points of ossification, one for the body, and one for each of the extremities.

OF THE ULNA.

457. *Form.* The *Ulna* or *Cubitus*, is a long irregular bone, situated at the inner part of the fore-arm. It is larger above than below, is a little longer than the radius, and like it is divided into a body and two extremities.

458. The *Body* or *Middle Portion* is curved forwards at its upper part, backwards and outwards at the lower, while its middle region is straight. Its *anterior surface*, which is concave above and below, gives attachment at its upper part, where it is broad, to the flexor profundus, which is also attached to its middle; and at the lower part, where it is narrow, to the pronator quadratus. Near its upper part is observed the orifice of a canal for the passage of vessels into the bone, which is directed upwards. The *posterior surface* is divided into two parts by a longitudinal prominent line; of these parts, the *inner*, which is broader, gives attachment, from above downwards, to the anconedus and extensor carpi ulnaris; while the *outer*, which is narrower, receives, in the same direction, the supinator brevis, extensors of the thumb, and extensor indicis. The *inner surface*, which is very broad and somewhat concave at the upper part, is covered for three fourths of its length downwards, by the flexor profundus; while at the lower part, it is much contracted, and becomes sub-cutaneous.

459. These three surfaces are separated by as many edges. The *outer* is sharp for three fourths of its length from above, rounded below, and gives attachment to the interosseous ligament. The *anterior edge*, which is more rounded, gives insertion, at its upper part, to the flexor profundus, and, below, to the pronator quadratus. The *posterior edge* is very distinct for three fourths of its length from above downwards, and there gives attachment to an aponeurosis common to the flexor carpi ulnaris, flexor profundus and extensor carpi ulnaris. It gradually becomes obliterated below.

460. The *Upper* or *Humeral Extremity* is very large, of an irregular form, difficult to be described, and is formed principally by two processes. One of these is called the *Olecranon.*[*] It is situated posteriorly, and at a much higher level than the rest of the bone. At its upper part it gives attachment to the triceps extensor. Posteriorly, it presents a narrow triangular surface, covered solely by the skin; while anteriorly it is concave and invested with cartilage. The other process, which is named the *Coronoid*, is situated before and beneath the olecranon. At its upper part it is cartilaginous and inclined backwards; but below, it is directed forward, and presents a very distinct impression for the brachialis internus. On the inside, it gives attachment to some fibres of the pronator teres and flexor sublimis, together with the internal lateral ligament of the elbow joint. Externally, it presents

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[*] *Ω'λεκρανον, cubiti pars gibbera; Ω'λενη, cubitus; κράνος, galea.*

an oval cavity with its greatest diameter from before backwards, which is covered with cartilage, and is named the *smaller sigmoid cavity*.* This cavity is articulated with the upper extremity of the radius, and is continued above into the *Larger Sigmoid Cavity*, which rolls upon the trochlea of the humerus, and which is formed by the anterior surface of the olecranon, and the upper surface of the coronoid process, which unite nearly at a right angle. Its posterior and vertical portion is larger than the anterior which is horizontal. It is also divided by a prominent line, which passes from the upper part of the olecranon to the summit of the coronoid process, into two lateral portions, of which the inner is the larger.

461. The *Lower* or *Carpal Extremity* is very small, and presents two eminences. The outer, which is named the *Head of the Ulna*, is rounded, covered with cartilage, contiguous at its lower part with the triangular fibro-cartilage of the joint, and received externally into the cavity of the lower extremity of the radius. The inner, or *Styloid process*, is more prominent, and is placed a little backwards. It is conical and slightly turned outwards. Its summit gives attachment to the internal lateral ligament of the radio-carpal articulation. Posteriorly these two eminences are separated by a groove, in which passes the tendon of the extensor carpi ulnaris, and below by an uneven depression into which is inserted the triangular fibro-cartilage just mentioned.

462. *Structure*, *Articulations*, and *Development*. The ulna, which is perfectly similar to the radius in its structure, is articulated with that bone, the humerus, and by intervention with the pyramidal bone. It is also developed by three points of ossification. Sometimes it presents a supernumerary bone at the summit of the olecranon or coronoid process. Soemmering has observed the latter case. Sometimes also there occurs a centre of ossification in the cartilage which is to form the styloid process.

IV.—OF THE BONES OF THE CARPUS.†

The carpal bones are eight in number, and form two rows.

FIRST ROW.

OF THE SCAPHOID BONE.

463. The *Scaphoid Bone*‡ *(os Scaphoides, os Naviculare)* is situated at the upper and outer part of the carpus, and is the largest of those that occur in the first row. It is elongated, convex on

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* Σιγμοειδης, having the form of the letter *sigma*, represented by C and not by Σ.

† Καρπος of the Greeks.

‡ Σκάφη, *navicula*; εἶδος, *figura*.

the side next the fore-arm, concave in the other direction, inclined downwards and outwards. Its *upper surface*, which is triangular, smooth, and cartilaginous, is articulated to the radius. The *inferior surface*, which is directed a little outwards and backwards, is also triangular and smooth, convex and covered with cartilage, and is articulated to the trapezium and trapezoides. The *posterior surface*, which is very narrow, is marked in its whole length by a groove into which ligaments are inserted. The *anterior*, which is also narrow, is concave at the upper and outer part, and presents a pretty distinct eminence for the insertion of ligaments. The *outer surface* is narrow and tubercular, and receives the insertion of the external lateral ligament of the radio-carpal articulation. The *inner* presents two concave and cartilaginous spaces, of which the upper is narrower, and is articulated to the semilunar bone; the under, broader, inclined downwards, forwards, and inwards, and is united to the head of the os magnum.

OF THE SEMILUNAR BONE.*

464. The *Semilunar Bone (os Lunatum)* is smaller and less elongated than the scaphoid. Its *upper surface* is convex and smooth, and is articulated to the radius. The *lower*, which is of greater extent from behind forwards than in the transverse direction, presents a concave space, which is connected with the head of the os magnum, and with the os unciforme. This articulating space is sometimes double. The *anterior* and *posterior* surfaces, which are uneven and rough, give attachment to ligaments. The former of these is the largest of all. The *outer surface*, which is a little concave, smooth, covered with cartilage, slightly inclined upwards, and of a semicircular form, is articulated to the scaphoid bone. The *inner surface* is directed a little downwards, and presents a broader, somewhat convex and nearly quadrilateral space, which rests upon the pyramidal bone.

OF THE PYRAMIDAL BONE.

465. The *Pyramidal*, *Triquetrous*, or *Cuneiform Bone*, is a little smaller than the semilunar, and is situated to the inside of that bone, and a little beneath it. Its form is that of a wedge, whose base is directed outwards and upwards, and the summit downwards and inwards. Its *upper surface* is convex and smooth, and is contiguous to a triangular cartilage, which separates it from the head of the ulna. The *inferior surface* is inclined outwards, a little concave and smooth, and rests upon the unciform bone; the *posterior surface* is uneven, and gives attachment to ligaments. The *anterior* presents internally a plain and circular

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* So named because the surface by which it is articulated to the scaphoid bone is of the form of a crescent.

surface, covered with cartilage, which articulates with the pisiform bone, and is limited externally by ligamentous impressions. The *outer surface*, which is quadrilateral, convex, smooth, and inclined a little upwards, is articulated to the semilunar bone. The *inner* is marked with an uneven depression for the insertion of ligaments.

OF THE PISIFORM BONE.

466. This is the smallest bone of the carpus, of which it occupies the inner and upper part. It is of a rounded form, whence its name; and is placed in a plane anterior to the other bones of the carpus. Posteriorly it presents a circular surface, which unites with the anterior surface of the pyramidal bone. All the rest of its surface is convex, rough, and uneven. It gives attachment above to the flexor carpi ulnaris, below to the abductor of the little finger; anteriorly, to the anterior annular ligament of the wrist.

SECOND ROW.

OF THE TRAPEZIUM.

467. The *Trapezium* is situated at the outer and lower parts of the carpus, a little before the other bones, and seems to have an oblique direction. Its *upper surface* is concave and cartilaginous, and articulates with the scaphoid bone. The *lower surface*, which is convex from behind forwards, and concave transversely, is connected with the first metacarpal bone; the *posterior* and *outer* present insertions of ligaments; the *anterior*, which is narrow and uneven, is marked above with a groove in which lies the tendon of the flexor carpi radialis, and of which the outer edge forms an eminence for the attachment of the anterior annular ligament of the wrist. The *inner surface* is inclined downward, and articulates with the os trapezoides by a broad and concave space, and with the second metacarpal bone by another narrow and plain surface, situated beneath the preceding.

OF THE OS TRAPEZOIDES.

468. The *Trapezoides* is smaller than the trapezium, more extended from behind forwards than in any other direction, and thicker behind than before. Its *upper surface*, which is concave, smooth, narrow and quadrilateral, is articulated with the scaphoid bone; the *lower* is divided by a prominent line passing from before backwards, into two parts, of which the inner is broader and somewhat concave, and unites with the second metacarpal bone. The *posterior surface* is convex and rough, for the attachment of ligaments; the *anterior* is of a similar description, but is narrower; the *outer* is convex and articulates with the trapezium, the *inner*, which is

narrower and concave anteriorly to be articulated to the os magnum, receives the insertions of ligaments behind.

OF THE OS MAGNUM.

469. The *os magnum* or *capitatum* is the largest of the carpal bones. It is thick and cubical below, rounded and hemispherical above, and its height is greater than any of its other dimensions. Its *upper surface*, which is named its *head*, has the greatest part of its convexity turned backwards and outwards. It is supported by a contracted neck, in the form of a groove, and is received into a cavity presented by the scaphoid and semilunar bones together. Its *inferior surface* is divided into three portions, of which the outer, which is inclined outwards and is concave and smooth, is articulated with the second metacarpal bone; while the middle portion, which is broader than the rest, horizontal, and turned a little obliquely upwards at its posterior part, rests upon the third metacarpal bone; and the inner, which is very small, plain, and also horizontal, is joined to the fourth. Its *posterior surface* is broad and convex below, a little concave above, and gives attachment to ligaments, as does the *anterior*, which is narrower. The *outer surface* is plain, and is articulated to the trapezium. The *inner surface*, presents posteriorly and above, a larger concave space, which is connected with the unciform bone; the remaining part is rough and gives attachment to ligaments.

OF THE OS UNCIFORME.

470. Next to the os magnum, this is the largest of the bones of the carpus, of which it occupies the inner and lower part. It presents somewhat of the form of a wedge, with the base directed downwards. Its *upper surface* is extremely narrow, rounded and smooth, and is articulated to the semilunar bone. The *lower surface* is divided into two portions, which rest upon the fourth and fifth metacarpal bones; the *posterior* is triangular and uneven, and gives attachment to ligaments; the *anterior* bears internally and below a large eminence, somewhat curved upon itself outwards, which affords attachment to the annular ligament of the wrist, and some of the muscles of the little finger; the *outer* is smooth above and behind to be articulated with the os magnum, uneven before and below where it gives insertion to ligaments; the *inner*, which is very oblique, is concave downwards and backwards, convex above and before, and is articulated to the pyramidal bone.

471. *Structure and Development.* All the bones of the carpus are formed of a loose and spongy tissue, which in the recent state is filled with a great quantity of fluid. A very thin layer of compact tissue invests their surface. They are developed by a single point of ossification, excepting the os unciforme, which has two. The pisiform bone does not begin to ossify until about the

age of twelve. In describing each of the carpal bones, we have already sufficiently pointed out their articulations to render it unnecessary to recur to them here.

V.—OF THE METACARPAL BONES.[*]

OF THE FIRST METACARPAL BONE.

472. This bone, like all those of the metacarpus, belongs to the class of long bones; it is shorter and thicker than the four others. Its *body* is a little curved from behind forwards. It is convex and covered by the tendons of the extensors of the thumb at its back part, and presents anteriorly, in the middle, a longitudinal ridge which gives attachment to the antagonist muscle and flexor brevis pollicis. Internally and at the upper part, where it is very narrow, the first interosseous muscle is inserted. Its *upper*, or *carpal extremity*, supports a smooth articular surface, concave from behind forwards, and convex transversely, which is connected with the trapezium. Externally, this extremity gives attachment to the tendon of the extensor ossis metacarpi pollicis. To the rest of its circumference a fibrous capsule is attached. Its *lower extremity*, or *head*, is convex and smooth, more prolonged and broader before than behind, and covered with a cartilage for the purpose of being articulated to the first phalanx of the thumb. There are observed at its anterior part two depressions which correspond to the sesamoid bones, and, on each side, a depression which receives the insertion of the lateral ligament.

OF THE SECOND METACARPAL BONE.

473. This is one of the longest and largest bones of the hand. Its *body*, which is curved like that of the preceding bone, is of a prismatic and trigonal form. Posteriorly, it presents a prominent longitudinal line, which bifurcates below, to form the sides of a triangular surface, of which the summit is turned upwards, and into which are inserted, externally, the first dorsal interosseous muscle, and, internally, the second. At its fore part it is surmounted by a blunt and rounded edge, which corresponds to the tendons of the flexors, and is more prominent below than above. Externally, it gives attachment to the first dorsal interosseous muscle, and, internally, and somewhat anteriorly, to the first of the palmar interossei. Its *upper extremity* is marked in the middle with a concave surface, which articulates with the os trapezoides. Externally, it presents a plain surface, inclined forwards, which unites with the trapezium; and, internally, a double articulating surface, of which the upper part is connected with the os magnum, and the lower with the third metacarpal bone. Poste-

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[*] Μετα, *post*; καρπος, *carpus*.

riorly, this extremity of the bone bears a tuberosity which gives attachment to the tendon of the extensor carpi radialis longior, and, anteriorly, inequalities for the tendon of the flexor carpi radialis. The *lower extremity*, or *head*, of this bone is similar to that of the first, and is articulated with the first phalanx of the forefinger.

OF THE THIRD METACARPAL BONE.

474. This bone is a little shorter than the preceding. Its *body* presents exactly the same disposition. Anteriorly, it gives attachment to the flexor brevis pollicis for the upper fourth part of its length, and in the lower three-fourths affords insertion to fibres of the adductor pollicis. Externally the second, and internally the third dorsal interosseous muscles, are inserted into it. Its *upper extremity* presents a nearly plain surface, horizontal at the fore part, inclined forwards and inwards posteriorly, which is articulated to the os magnum. Posteriorly, this extremity gives attachment to ligaments, and to the tendon of the extensor carpi radialis brevior. Anteriorly, it receives ligaments only. Externally, it presents a concave smooth surface, which is articulated with the second metacarpal bone; and, internally, there are observed two surfaces separated by a depression, which are connected with the fourth metacarpal bone. Its *lower extremity*, which is articulated with the first phalanx of the middle-finger, is similar to that of the preceding bone.

OF THE FOURTH METACARPAL BONE.

475. It is shorter and smaller than the third, and presents the same form in its *body*, which gives attachment externally to the second palmar, and third dorsal interosseous muscles, and on the inside to the fourth dorsal. Its *upper extremity* presents two smooth articular surfaces, of which the inner is broader and somewhat concave, and articulates with the unciform bone, while the other, which is external and posterior, is very small and plain, and is connected with the os magnum. Before and behind, this extremity gives attachment to ligaments; externally, it has a double surface connected with the third, and internally a simple surface, somewhat concave, united to the fifth metacarpal bone. The *lower extremity* is articulated to the first phalanx of the ring-finger.

OF THE FIFTH METACARPAL BONE.

476. This bone is shorter than the fourth. Its *body* is a little flattened from behind forwards. Posteriorly, it is marked with an oblique line which divides it diagonally into two portions, the outer of which is concave, and gives attachment to the fourth dorsal interosseous muscle, while the inner, which is convex and broader, is covered by the tendons of the extensors of the little fin-

ger. To the outside and anteriorly, it gives attachment to the third palmar interosseous muscle, and, internally, where it is narrow and uneven, to the adductor minimi digiti. The *upper extremity* presents a concave surface, directed a little outwards, and articulated with the os unciforme. There are seen upon it, internally, a tuberosity for the attachment of the extensor carpi ulnaris, externally, an articulating surface for the fourth metacarpal bone, and at the fore part impressions of ligaments. The *lower extremity* is connected with the first phalanx of the little finger.

477. *Structure* and *Development.* The metacarpal bones have the same structure as the long bones in general; in other words, their body is compact, and their extremities cellular. In the middle of the anterior surface of their body, the aperture of their principal canal for the vessels of the bone is observed, its direction being upwards. The first is developed by two points of ossification, one for the body and the other for the upper extremity. The other four have also two, one for the body and the other for the lower extremity.

478. *Articulations.* The first is articulated with the trapezium and the first phalanx of the thumb; the second with the trapezium, trapezoides, os magnum, the third metacarpal bone, and the first phalanx of the fore finger; the third with the os magnum, the second and fourth metacarpal bones, and the first phalanx of the middle finger; the fourth with the os magnum, os unciforme, the third and fifth metacarpal bones, and the first phalanx of the ring finger; the fifth with the os unciforme, the fourth metacarpal bone, and the first phalanx of the little finger.

VI.—OF THE BONES OF THE FINGERS.

479. The *fingers* are composed of fourteen bones, named *Phalanges.** Each of them has three, excepting the thumb, in which there are only two. Those next the metacarpus are longer and larger; the extreme series is the smallest, and the middle bones are of an intermediate character. In all of them the upper extremity is larger than the lower; the anterior surface is concave, and the posterior convex, the former being connected with the tendons of the flexors, the latter with those of the extensors of the fingers.

OF THE FIRST OR METACARPAL PHALANGES.

480. There is one of these bones for each finger. That of the middle finger is the longest, while the one belonging to the little finger is the shortest and weakest. Their *anterior surface* forms a sort of groove which lodges the tendons of the flexor muscles, and whose thin and rough edges give attachment to the fibrous sheath of these tendons. The upper extremity, which is of a

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* Φάλαγγες, from φάλαγξ, *acies*, they being compared to soldiers arranged in order.

quadrilateral form with rounded angles, presents a transversely oval cavity, which is articulated with the head of the corresponding metacarpal bone, and whose sides have inequalities for the attachment of the lateral ligaments. That of the first phalanx of the thumb receives the insertions of the abductor, flexor brevis, and adductor pollicis. Their *lower extremity* is surmounted by two small condyles separated by a groove, more prolonged before than behind, and articulated with the next phalanx.

OF THE SECOND OR MIDDLE PHALANGES.

481. In the thumb the middle phalanx is wanting. That of the middle finger is the longest, while the one belonging to the little finger is the shortest and smallest. They have a great resemblance to the first phalanges, only that there are observed at their middle and fore part two impressions, to which the terminations of the tendons of the flexor sublimis are attached, and that their *upper extremity* presents two concave surfaces separated from before backwards by a prominent line, for its articulation with the condyles of the metacarpal phalanges, and inequalities, at its posterior part, for the attachment of a portion of the tendon of the extensor communis digitorum.

OF THE THIRD OR EXTREME PHALANGES.

482. Each of the fingers, including the thumb, has one. That of the thumb is the largest; the smallest is that of the little finger. They are destitute of a body, and have the form of a truncated and compressed pyramid. Their *posterior surface* is convex and covered by the nails; the *anterior* is concave at its middle part, and gives insertion to the tendon of the flexor profundus. The *base* is marked with two cavities similar to those of the upper extremities of the middle phalanges, and articulated with the condyles of their lower extremity. On the sides are seen the impressions of the lateral ligaments, and posteriorly the attachment of the tendons of the extensor communis digitorum. The *summit* is rounded, compressed, very uneven, tubercular, broader than the body, and connected with the pulp of the fingers.

483. *Structure*, *Articulations*, and *Development*. The first and second phalanges are similar to the metacarpal bones in respect to structure, and are equally furnished with a medullary canal; the last phalanges are entirely formed of cellular tissue, covered with a slight layer of compact tissue. The first phalanges are articulated with the metacarpal bones, and with the second or middle; the second phalanges, with the first and last; the latter, with the second, excepting that of the thumb, which is immediately connected with the first. They are developed by two points of ossification, one for the body, the other for the upper extremity. Their inferior extremity is not furnished with a centre of its own.

OF THE SUPERIOR EXTREMITIES CONSIDERED IN GENERAL, WITH REFERENCE TO THE BONES OF WHICH THEY ARE COMPOSED.

484. The upper extremities, whose length is such that, in the standing posture, the tips of the fingers reach the middle of the thigh, are composed each of thirty-two bones, the weight of which is sustained by the connections, more or less remote, of the shoulder with the head, the neck, and the vertebral column. In order to point out the different regions into which they are divided for the purpose of facilitating their examination, they are supposed hanging by the side of the body, with the palm of the hand turned forwards. The following peculiarities are then observed in each of the portions of which they consist.

485. The *Shoulder* is applied upon the upper part of the thorax, in such a manner as to increase its transverse extent on the outside in a great degree. It is longer than broad, and this length is more marked in the female than the male, on account of the greater development of the mammæ, which induces an enlargement of the chest at its upper part. With respect to its height, it is the scapula alone that can serve to furnish an estimate of it, the clavicle being of no importance in this respect.

The shoulder is in general inclined backwards, and the glenoid cavity of the scapula turned directly outwards. The two bones of which it is formed constitute a bent and horizontal lever, which is so disposed that the summit of the angle is above the glenoid cavity, and its base directed inwards and backwards.

486. The *Arm*, or portion of the thoracic extremity extended between the shoulder and elbow, is formed by a single bone already described, and scarcely presents any thing for our examination in its general conformation. It is protected at its upper part by the projection formed by the acromion and coracoid process. The pulley which is observed at its lower part is oblique, so as to be directed forwards toward the inner edge of the bone, and outwards toward its outer side. The inner tuberosity of this extremity corresponds to the head of the humerus, and the outer tuberosity to the large tuberosities of the upper extremity.

487. The *Fore-arm*, which is situated between the arm and hand, is flattened from before backwards, curved a little forwards, and of nearly uniform breadth in its whole length. The two bones of which it is composed, are so disposed that the thickest part of the one corresponds to the thinnest part of the other, so that, in the different parts of the extent of the fore-arm, the sum of their diameters remains almost uniformly the same. Both are rounded on the side where they are farthest from each other, and terminate in a sharp edge on that by which they mutually approach. They are in contact at their two extremities; but in the middle are separated by an interval named the *interosseous space*, which is contracted above and below, and in the recent state is closed by a membraniform ligament. Their two carpal extremities are situated nearly

at the same level; the upper extremity of the ulna rises about a twelfth part above that of the radius. The latter is in general situated in a plane a little anterior to that of the radius. At the elbow, it is the ulna that principally forms the joint; but at the wrist, the radius is the chief constituent, and thus draws along with it the hand in all its motions.

We have supposed the upper extremity hanging along the side of the body, with the back of the hand directed backwards. This position is what is termed *supination.* The term *pronation,* again, is applied to the position in which the back of the hand is directed outwards, while the thumb is turned forwards. In pronation, the radius is in its natural place at the upper extremity, while its lower turns upon the ulna; and in this state the two bones cross each other.

488. The *Hand,* or last part of the thoracic extremities, varies in its dimensions in different individuals, and is more extended in height than in breadth. It is also broader than the fore-arm. Its *anterior surface,* which is concave, is named the *palm;* the *posterior,* which is convex, and a little inclined upon the fore-arm, is named the *back of the hand.* Its *outer* or *radial edge* is thicker than the *inner.* The hand is divided into the following parts.

489. The *Carpus* or *Wrist,* which commences the hand in the skeleton, and which is articulated to the fore-arm, being scarcely broader than it, is transversely oval. Its height is inconsiderable. It is flattened from before backwards, and slightly curved forwards. Its *posterior surface* is in general convex, and traversed by an unequal depression which indicates the separation of the two rows of bones of which it is composed. Its *anterior surface,* which is concave, represents a sort of groove in which pass the tendons of the flexor muscles of the fingers, together with nerves and vessels. The scaphoides and trapezium externally, and the pisiform bone with the process of the os unciforme internally, form four eminences which limit this groove on the sides, and to which are attached the muscles of the thumb and little finger, as well as the anterior annular ligament of the wrist. The two surfaces of the carpus are in general very uneven for the insertion of ligaments. The posterior surface forms part of the back of the hand, and is covered by the extensor muscles of the fingers.

490. On the side next the fore-arm, the carpus presents a convexity more prolonged backwards than forwards, which is covered with cartilage in the recent state, and is articulated with the bones of the fore-arm to form the wrist-joint. At the lower part it is terminated by a certain number of articular surfaces, which are connected with the metacarpal bones. Externally and internally, it presents inequalities which give insertion to ligaments.

491. *Metacarpus.*—This part of the hand, which is situated between the carpus and fingers, is of a quadrilateral form, broader below than above. It is concave before, convex behind, and presents very distinct intervals existing between the bones of which it

is composed, and which, with the exception of the first, are in contact at the upper extremities. The space which occurs between the first and second is also much larger than the others. It is in these intervals that the interosseous muscles are lodged.

492. The *Fingers*[*] are five in number, and are designated by their numerical name, counting from the radius towards the ulna. The first is named the *Thumb* or *Pollex;* the second the *Fore-finger* or *Index*, the latter name being applied to it from its being used to point out a distant object; the third is named the *Middle Finger*, on account of its position; the fourth, the *Ring Finger*, because it is on it that rings are usually worn; lastly, the fifth is named the *Little Finger*, from its inferior size, and occasionally the *Auricular*, from its being the only one that can easily be introduced into the external auditory canal.

The fingers vary much in their dimensions. The middle finger is the longest; the index and ring-fingers follow next; the thumb and little finger are the last in this respect. But with respect to thickness the following is the order which they follow:—first the thumb, then the middle finger, the fore-finger, the ring-finger, and lastly the little-finger. In general the dorsal surface of the fingers is convex in the longitudinal, and more especially in the transverse direction. Their palmar surface presents a corresponding concavity. The thumb is straighter than the others.

OF THE INFERIOR OR ABDOMINAL EXTREMITIES.

1. OF THE THIGH.

OF THE FEMUR.

493. Form. The *Femur (Femoral Bone, Os Femoris)* is the longest, largest, and heaviest, of all the bones of the body. It is of a cylindrical form, somewhat curved anteriorly, directed obliquely downwards and inwards, and slightly twisted upon itself, so that in the skeleton it is much nearer the corresponding bone of the opposite side at its lower extremity, than at the upper, where it is separated to a considerable distance. Being a double bone, it is consequently unsymmetrical, which is equally the case with all the other bones of the lower extremity. The Femur rests upon the leg, and transmits to it the weight of the pelvis, with which it is articulated at its upper part. The following parts are observed in it.

494. The *Body*, which is pretty thick above, contracted in the middle, and greatly enlarged below. It is slightly twisted upon itself, and presents a very distinct curvature of which the convexity is anterior. It is somewhat triangular for three-fourths of its

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[*] Δάκτολοι among the Greeks; *Digiti* among the Latins.

length, and is flattened from before backwards in the remaining or lower fourth.

Its *anterior surface*, which is convex, broader above and below than in the middle, and slightly twisted upon itself, gives attachment in the three upper fourths of its length to the triceps extensor, which covers it entirely. The *outer surface* is slightly concave above, convex below, and gives attachment to the external portion of the triceps extensor muscle. The *inner surface*, is broader than the preceding, nearly plain, and covered by the inner portion of the triceps extensor, to which it gives attachment in its two upper thirds.

495. These surfaces are separated by three *edges*, of which two are *lateral*, rounded, rather indistinct, and give attachment to the triceps extensor muscle. The third is *posterior*, very prominent, rough, and furnished with distinct asperities, and has received the name of *Linea aspera*. This line, whose direction is parallel to the axis of the bone, is much more distinct at its middle part than at the extremities. It has besides a certain breadth, and presents two lips or edges separated by an interval, and retiring to a great distance from each other at the upper and lower parts of the bone, which makes it appear bifurcated at its two extremities. It gives attachment externally to the triceps extensor and the short head of the biceps. Internally, it also receives the insertion of the former of these muscles; while its middle part receives a portion of the fibres of the three adductor muscles of the thigh. The canal for the vessels of the bone, which is directed upwards, is seen at the middle of this line. It is generally single, but occasionally there are two or three apertures. The external branch of the upper bifurcation of the linea aspera ascends to the trochanter major. It is very rough, and gives attachment externally to the triceps extensor, internally to the adductor magnus, and in the middle to the tendon of the gluteus maximus. The internal branch, which is not very distinct, passes upwards and inwards to the trochanter minor, and gives attachment to the pectineus and triceps extensor. The quadratus femoris and adductor magnus cover the triangular interval existing between these branches. The branches of the lower bifurcation of the linea aspera are longer than those of the upper. They descend toward the posterior part of the condyles, above which they terminate by very distinct impressions, and are more widely separated than those of the upper bifurcation. The external branch, which is more prominent than the inner, affords insertion to the triceps extensor and biceps flexor muscles; the internal, which is depressed at its upper part, and even almost entirely effaced toward the middle for the passage of the crural artery, which runs across it, gives attachment to the triceps extensor and adductor magnus. These two lines are separated by a triangular flattened surface, which corresponds to the popliteal vessels and nerves, and is limited at its lower part, and laterally by rough impressions, which are placed immediately above the posterior extremity of the condyle, and which give attachment to the tendons of the gastrocnemius externus muscle.

496. The *Upper*, or *Pelvic Extremity.* This extremity which is angularly curved beyond its union with the body of the bone, and is of a very irregular form, presents three large processes. One of these, which is the largest and highest of the three, is called the *Head of the Femur.* It is of a spherical form, and is directed obliquely upwards, inwards, and a little forwards. At the middle, or a little below it, there is observed a small ragged and uneven depression, which gives attachment to the round ligament of the hip joint. This head is covered with cartilage, and is articulated with the cotyloid cavity of the iliac bone. It is supported by an elongated *Neck*, flattened from before backwards, which forms a more or less obtuse angle with the axis of the body of the bone.[*] This neck is thicker at the place where it joins the bone than anywhere else, and there, in fact, appears to bulge out. It is longer and smaller below and behind than above and before. The head is separated from the neck, by a variously contorted line which corresponds to the circumference of the cartilage by which the head is invested. Two other broad and scabrous lines, directed obliquely inwards and downwards, proceeding from the great to the small trochanter, and situated the one before, the other behind the base of the neck, indicate its junction with the body of the bone, and give attachment to the capsular ligament. The part of the neck which is next the head is rounded and smaller. In the rest of its extent it has the form of a triangular prism, with very blunt angles.

497. The second process of the upper extremity of the femur is named the *Great Trochanter,*[†] *(Trochanter Major.)* It is a broad, thick, rough, quadrilateral eminence, flattened from before backwards, occupying the outermost part of this region of the femur, and situated at a lower level than the head. The *Outer Surface* of this process is broad and convex. It is covered by the tendon of the gluteus maximus, from which it is separated by a synovial bursa. It is terminated below by a rather prominent ridge, which gives attachment to a portion of the triceps extensor muscle. Its *Inner Surface* presents at its upper part an irregular depression named the *Digital Cavity*, which gives attachment to the tendons of the pyramidalis, superior and inferior gemelli, obturator internus, and obturator externus muscles. The *Anterior Edge* of the great trochanter is not very prominent, but is very broad and rough. It gives insertion to the tendon of the glutæus minimus. Its *Posterior Edge* is rounded and more distinct, but narrower, and receives the tendon of the quadratus femoris. Its *summit*, which is short, thick, and very rough, gives attachment to the glutæus medius.

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[*] This angle changes with age, until at last the head sinks below the level of the Trochanter Major: it changes also its level, the neck shortens and the head of the bone becomes *sessile*, to use the language of Botanists, from the disease termed by Mr. B. Bell "Interstitial Absorption," and has been in this condition, frequently mistaken by Surgeons for cases of fracture in the neck of the bone which had healed by osseous union. See "Remarks on Interstitial Absorption of the neck of the thigh bone. By Benjamin Bell, Surgeon." Edin. 1824.—K.

[†] Τροχαντήρ μεγας of the Greeks, from Τροχος, a wheel.

498. The *Small Trochanter,** *(Trochanter Minor,)* is situated beneath and behind the base of the neck of the femur, and much lower than the great trochanter. Its form is pyramidal, and its direction obliquely inwards and backwards. Its summit gives attachment to the united tendon of the psoas magnus and iliacus internus. From its base, which is triangular, there proceed three prominent lines; two superior, of which the one ascends obliquely outwards to the great trochanter, while the other proceeds obliquely inwards, to be continued into the lower part of the neck; and one inferior, which directs itself toward the linea aspera, and forms the inner branch of its superior bifurcation.

499. The *Lower*, or *Tibial Extremity*, which is larger than the upper, is a little flattened from before backwards, and is thinner in its middle part than on the sides, which are formed of two considerable eminences, known by the name of *Condyles of the Os Femoris.* These condyles articulate with the tibia, and are distinguished into internal and external. The *Internal Condyle* is narrower, less prominent anteriorly, more oblique, more prolonged backwards than the other, and also descends lower when the femur is placed in a vertical direction, but remains on the same level with it when the bone is restored to its natural obliquity. These two condyles present a greater convexity behind than before. They are separated posteriorly by a large notch, very uneven in its bottom, which is prolonged between them, and which is destitute of articular cartilage, and lodges the crucial ligaments of the knee-joint. Anteriorly, they come close together, their surfaces seeming to be continued into each other, and unite by means of a sort of pulley or surface, which is convex from above downwards, concave transversely, more prominent and higher externally than internally, and formed especially at the expense of the outer condyle, of which it occupies all the fore part, and articulated with the patella. The inner condyle presents internally an uneven projecting eminence, named the *Internal Tuberosity of the femur*, which gives attachment to the internal lateral ligament of the knee-joint, and to the tendon of the adductor magnus. Externally, it gives insertion to the fibres of the posterior crucial ligament by an uneven and rough surface. The outer condyle presents externally the *External Tuberosity of the femur*, which is less prominent than the internal, uneven, rough, convex, and gives attachment to the external lateral ligament of the knee-joint. Beneath this tuberosity there is observed a pretty wide groove, which receives the tendon of the popliteus muscle.† Internally, this condyle presents an uneven ru-

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* Τροχαντήρ μίκρος of the Greeks.

† The groove described in the text receives the tendon of the popliteus muscle only during the flexion of the knee joint, the tendon being inserted into one extremity of it. The osseous surfaces of the groove are encrusted with cartilage, and with the synovial membrane, thus forming a part of the articulation of the knee. So long as the limb is extended, the tendon of the popliteus is not in the groove; but as the knee bends, the tendon slides over the smooth lip of it, and should the flexion continue to a considerable degree, the tendon at last slips into the groove;

gose surface, at the posterior part of which is inserted the anterior crucial ligament. Very convex behind, nearly flat before, and very broad beneath, this condyle differs considerably from the inner, which is more convex anteriorly and less broad below.

500. *Structure.* The femur presents the structure common to all the long bones, in other words, is formed of compact tissue in its body, and of cellular tissue in its extremities. Its compact tissue appears evidently fibrous at the outside, and especially on the neck. A large cylindrical medullary canal occupies the whole interior of the bone, and presents a multitude of broad laminæ which detach themselves from its walls, together with very slender interlaced filaments.

501. *Development.* The femur is developed by five points of ossification, one for each of the three processes of the pelvic extremity, one for the body, and one for the two condyles of the lower extremity.

502. *Articulations.* It is articulated with the iliac bone, the tibia, and the fibula, by the various parts already mentioned.

2.—OF THE LEG.

OF THE PATELLA.

503. The *Patella* or *Rotula* is an irregular flattened bone, of inconsiderable size, occupying the anterior part of the knee. Its form is that of a triangle rounded on the angles. Its *Anterior Surface* is convex, uneven, covered with a great number of small vascular apertures and longitudinal striæ which indicate the direction of the fibres of the bone. It is covered by tendinous and aponeurotic expansions and by the skin. The *Posterior Surface* is separated into two portions covered with cartilage and articulated with the condyles of the femur, by a prominent line which descends obliquely inwards from the base of the bone towards its lower angle. Of these two portions, the outer is larger and deeper than the inner, in conformity to the disposition of the articular part of the corresponding condyle. Beneath them is seen a small triangular rough surface, into which is inserted the ligament of the patella.

504. The *Base of the Patella*, which is thick, directed upwards, and cut obliquely downwards and backwards, gives attachment to the tendon of the rectus femoris. Its two *Lateral Edges*, which are thin, convex, and prominent, receive aponeuroses from the triceps extensor. Its *Summit*, which is sharp and directed downwards, gives insertion to the ligamentum patellæ.

505. *Structure.* The patella is almost entirely formed of very

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so that it may be said to have been *formed for the occasional reception* of the tendon of the popliteus. This mechanism which has scarcely been properly described by any Anatomist, was well understood by Winslow. We shall return to this structure when describing the functions of the popliteus muscle.—K.

dense cellular tissue, traversed by longitudinal bony fibres, and covered with a very thin layer of compact tissue. It appears to borrow this peculiar structure from the fibrous basis in which it is developed. It in fact originates in the midst of the tendon of the extensor muscles of the leg, which then seem to become incrusted with phosphate of lime.

506. *Development* and *Articulations*. The patella originates by a single centre of ossification. It remains long cartilaginous, and only becomes entirely osseous at a pretty advanced age. It is articulated with the condyles of the femur, and is connected with the tibia by the ligamentum patellæ.

OF THE TIBIA.*

507. Form. The *Tibia* is the largest and longest of the two bones of the leg, of which it occupies the inner and fore part. Next to the femur, it is the largest bone in the body. It is divided into the following parts.

508. *Body*. This part is prismatic and triangular. Its thickness diminishes from the upper part to the lower in a general manner, but the place where it is smallest is below the middle third. Independently of its being twisted upon itself, like all the long bones, it presents a double curvature, which is such that internally its two upper thirds are slightly convex, while the lower is a little concave. Its *Inner Surface*, which is directed a little obliquely forwards, slightly convex, and broader above than below, is covered at the upper part by the tendinous expansions of the sartorius, gracilis and semitendinosus muscles, while in the rest of its extent it lies immediately under the skin. Its *Outer Surface*, which is also broader above than below, is concave in its two upper thirds, where the tibialis anticus is inserted, and convex in the remaining third which is covered by the tendons of that muscle, of the extensor communis digitorum, extensor proprius pollicis and peroneus tertius. Its *Posterior Surface* is also broader above than below, and is slightly convex in its whole extent. Its upper part is traversed by a prominent line which directs itself obliquely downwards and outwards, and into which are inserted the popliteus, soleus, tibialis posticus, and flexor communis digitorum pedis. The portion of the posterior surface of the tibia which is situated above this line, is of small extent, of a triangular form, and covered by the popliteus muscle ; that which lies beneath it, being of greater size, is covered by the tibialis posticus and flexor longus digitorum, to which it gives attachment. In the upper part of this surface is seen the orifice of the canal for the vessels of the bone, the direction of which is obliquely downwards and forwards. It is the

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* *Tibia*, a pipe or flute. It is affirmed that the first instruments of this sort were made by shepherds of the leg bones of animals.

largest of all the canals of this kind that are met with in the long bones.

509. These surfaces are separated by three edges. The *anterior* is more prominent at its middle part than above, and especially than at the lower part, where it is rounded and disappears altogether. It is called the *Crest of the Tibia.* It is twisted like the body of the bone, and gives attachment to the aponeurosis of the leg. The *inner edge* is thick, rounded, more distinct below than above, where it gives attachment to the internal lateral ligament of the knee joint. To this edge are attached the popliteus, soleus, and flexor longus digitorum pedis. The *outer* edge is thin and sharp, and gives insertion to the interosseous ligament. It is bifurcated at the lower part.

510. The *upper, or Femoral Extremity,* which is larger than the lower, is transversely oval. It presents at its upper part two articular surfaces, which are concave, covered with cartilage in the recent state, and articulated with the condyles of the femur. They are improperly known under the name of *Condyles of the Tibia.* The inner, which is deeper than the other, is of an oval form from before backwards. The outer, which inclines a little obliquely downwards and outwards, has a nearly circular form. A pyramidal process, with a broad base, inclined obliquely upwards and inwards, surmounted by two tubercles, situated at a greater distance from the fore than the back part of the bone, and named the *Spine of the Tibia,* separates these two surfaces, and presents anteriorly and posteriorly two uneven depressions which give attachment to the semilunar fibro-cartilages, and the crucial ligaments of the knee joint. The anterior is larger than the posterior.

The upper extremity of the tibia is limited anteriorly by a triangular, somewhat convex surface, directed obliquely forwards and downwards, presenting a great number of vascular apertures, and at its lower part a tubercle to which is attached the ligamentum patellæ. Posteriorly there is observed a more or less deep notch. On the sides two considerable eminences are met with, which are named the *Tuberosities of the Tibia.* The inner is very large, more distinct than the outer, and gives attachment to the internal lateral ligament of the knee joint, and posteriorly to the tendon of the semimembranosus muscle. The outer presents at its back part a small rounded surface, somewhat convex, nearly circular, directed downwards, and covered with cartilage to be articulated to the upper extremity of the fibula.

511. The *Lower* or *Tarsal Extremity* has a nearly quadrilateral form, and presents anteriorly a broad convex surface, which gives attachment to ligaments, and is covered by the tendons of the muscles of the fore part of the leg. Posteriorly, there is observed another surface, nearly plain, and traversed from above downwards by a superficial groove, in which slides the tendon of the flexor longus pollicis pedis. At its lower part it also receives insertions of ligaments. To the outside is seen a concave triangu-

lar surface, rough above where a ligament is attached to it, broad, smooth, and polished below, to be connected with a similar surface of the lower extremity of the fibula. It is at the summit of this surface that the outer edge of the body of the tibia terminates. Internally there is seen a thick triangular process, directed downwards, and flattened from within outwards. This is the *Malleolus Internus* or inner ankle. It is not placed in the same plane with the internal tuberosities of the tibia, but is a little anterior to it, which appears to depend upon the twisting of the body of the bone. This process is convex and subcutaneous internally. Externally it presents a small triangular surface, which unites nearly at a right angle with the lower articular surface of this extremity of the tibia, and is connected with the astragalus. Anteriorly and posteriorly, it is terminated by two thick edges, of which the anterior is convex and gives attachment to ligaments, the posterior marked with one or sometimes two superficial grooves, directed downwards and inwards, in which slide the tendons of the tibialis posticus and flexor longus digitorum. The summit of the malleolus internus is broader and descends less behind than before. It gives attachment to the internal lateral ligament of the ankle joint. Inferiorly, the tarsal extremity of the tibia is terminated by a concave quadrilateral surface, broader externally than inwards, separated into two parts by a very superficial prominence which traverses it from before backwards. This surface which is limited internally by the external surface of the malleolus internus, and externally by the notch which receives the lower extremity of the fibula, is articulated to the upper surface of the astragalus.

512. *Structure.* The tibia presents the structure common to all the long bones, its body being formed of compact tissue, and its extremities of cellular tissue covered with a layer of compact tissue. Its medullary canal is the most distinct of any in the body.

513. *Articulations* and *Development.* This bone is developed by three points of ossification, one for the body and one for each extremity. The spine which terminates its crest above is sometimes formed by a small lenticular epiphysis which does not long remain distinct. The malleolus internus is also sometimes developed by itself. The tibia is articulated to the femur, the fibula and the astragalus.

OF THE FIBULA.*

514. *Form.* The *Fibula* or *Perone* is nearly of equal length with the tibia, but much more slender, and occupies the outer part of the leg. It has a slightly oblique direction, which is such that its lower extremity is more forward than the upper. The following parts are observed upon it.

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* Περονή of the Greeks; *Fibula* among the Latins.

515. The *Body*, which is slender, rounded at the upper part, prismatic and triangular in the rest of its extent, is twisted upon itself, and slightly curved outwards. Its *inner surface* looks a little backwards at its upperpart, and is afterwards twisted so as to become anterior. It is divided by a longitudinal ridge, to which the interosseous ligament is attached, into two portions, of which the anterior and smaller gives attachment to the extensor longus pollicis pedis, extensor communis digitorum and peroneus tertius; while the posterior, which is larger, and a little concave in the longitudinal direction, represents a sort of groove which gives attachment to the tibialis posticus. Its *outer surface*, which looks a little forwards at its upper part, and backwards at the lower, gives attachment above to the peroneus longus, and in the middle to the peroneus brevis, which almost entirely cover it. The *posterior surface* looks a little outwards above, and is afterwards turned to be directed inwards at its lower part. Superiorly, it gives attachment to the soleus, and below to the flexor longus pollicis pedis. In its middle part is seen the orifice of the canal for the vessels of the bone, which is directed forwards and downwards. At its lower part, this surface, which has become broader, presents a triangular, convex, rough space, which is articulated with the tibia.

516. The surfaces of the fibula are separated by three edges. The *anterior* is directed outwards at its lower part, and gives attachment internally to the extensor communis digitorum pedis and peroneus tertius, and externally receives the insertions of the lateral peronei. At the lower part it bifurcates, and the branches of this bifurcation are separated by a triangular surface, somewhat concave, and covered by the integuments. The *internal edge* is turned forwards at its lower part, and is much more prominent in the middle than at its extremities. Above, it gives attachment to the tibialis posticus, and flexor longus pollicis pedis, and at the lower part receives the insertion of the interosseous ligament. The *external edge* is turned backwards at its lower part, and gives attachment posteriorly to the soleus and flexor longus pollicis pedis, and anteriorly to the two lateral peronei.

517. The *Upper*, or *Tibial Extremity*, is rounded, and is generally known by the name of the *Head of the Fibula*. It presents a somewhat concave surface, inclined inwards and forwards, which is articulated with the external tuberosity of the tibia. It is terminated posteriorly by a pyramidal process, which is directed upwards. Its whole circumference presents inequalities which give attachment to ligaments, and especially to the external lateral ligament of the knee-joint, and the tendon of the biceps flexor muscle.

518. The *Lower*, or *Tarsal Extremity*, is elongated, flattened from within outwards, terminated inferiorly by a pointed projection, and forms the *Malleolus Externus* or *Outer Ankle*, which is larger, and descends lower than the internal. Its *outer surface* is convex,

and lies immediately under the skin. The *inner* presents a small triangular smooth surface, concave from behind forwards, convex from above downwards, which is articulated to the astragalus, and is limited behind by a rough uneven depression, giving attachment to one of the posterior ligaments of the ankle-joint. Above this articular surface is a rough triangular space, which connects the fibula with the tibia. Anteriorly, the malleolus externus presents a thin uneven edge, into which ligaments are inserted. Posteriorly, is another much broader edge, in which there is formed a groove for the passage of the tendons of the lateral peronei muscles. Its summit forms a pyramidal eminence which gives insertion to the external lateral ligament of the ankle-joint.

519. *Structure*, *Development*, and *Articulations*. The body of the fibula is formed of compact tissue. Its extremities are chiefly composed of cellular tissue. It contains a medullary canal. It is developed by three points of ossification, one for the body, and one for each extremity; and is articulated to the tibia and astragalus.

III.—OF THE BONES OF THE TARSUS.*

OF THE CALCANEUM, OR OS CALCIS.†

520. This bone occupies the posterior and inferior part of the tarsus, and especially contributes to form the heel by the large prominence which it presents behind. It is elongated posteriorly, and slightly compressed internally and externally. It is the largest bone in this part of the lower extremity.

Its *upper surface* presents posteriorly a space, concave from before backwards, convex in the transverse direction, situated anteriorly to the tendo Achillis; in the middle a broad convex articular surface, looking forwards and outwards, and articulated to the astragalus; anteriorly and to the outside, a rough uneven depression for the attachment of ligaments; anteriorly, and to the inside, another articular surface, narrow, oblong, and slightly concave, which is also articulated with the astragalus, and which is separated from the preceding by a deep rough transverse groove, into which is inserted a ligament proceeding toward the astragalus. This surface is formed upon a projection which the bone here makes, and which is uneven on the inside to give attachment to the internal lateral ligament of the ankle-joint. It is named the *Small Process of the Calcaneum*.

Its *lower surface*, which is much narrower than the upper, presents posteriorly two tuberosities, of which the inner is the largest. These tuberosities afford insertion to the superficial muscles of the sole of the foot, and are separated by a depression into which a stout ligament is fixed. Anteriorly, this surface contracts still more, and is terminated by a rough tubercle into which is inserted the inferior calcaneo-scaphoid ligament.

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* Ταϱσος of the Greeks; *Tarsus* among the Latins.

† Σκελὶς of the Greeks; in Latin, *Culx*, the Heel.

The *anterior surface* of the calcaneum is the smallest of all. It is concave from above downwards, slightly convex from without inwards, covered with cartilage, and articulated to the os cuboides. The portion of the bone which sustains this surface is contracted, and has received the name of the *Great Process of the Calcaneum.*

Its *posterior surface,* which is convex in all directions, presents inequalities at its lower part, where the tendo Achillis is inserted. Its upper part is smooth and polished, and is separated from the tendon just mentioned by a synovial bursa.

Its *outer surface,* which is broader behind than before, is marked anteriorly with two superficial grooves, directed downwards and forwards, for the passage of the tendons of the lateral peronei muscles. It lies, in a great part of its extent, immediately under the skin, and presents anteriorly, on the great process, inequalities to which the extensor brevis digitorum pedis is attached. The two grooves are separated by a spine into which is inserted the external lateral ligament of the ankle joint.

Lastly, its *inner surface,* which is broad, concave from before backwards, slightly convex from above downwards at its posterior part, forms an arch under which slide the tendons of the flexor longus digitorum pedis, tibialis posticus, and flexor longus pollicis pedis. The tendon of the latter muscle passes in a very distinct groove, which occupies the upper part of this surface, and which is formed under the small process. The plantar vessels and nerves are also lodged in this cavity. Posteriorly and below, it presents inequalities to which the accessory muscle of the flexor longus digitorum is attached.

OF THE ASTRAGALUS.*

521. The *Astragalus,* which, next to the calcaneum, is the largest bone of the tarsus, is of a very irregular and somewhat cubical form, and occupies the middle and upper part of the tarsus, where it appears as if wedged in between the two malleoli. Its *upper surface* is formed, in its two posterior thirds, by an articular surface broader before than behind, convex from behind forwards, inclined backwards, a little concave in the transverse direction, which represents a kind of pulley with a shallow groove, articulated with the lower extremity of the tibia, and having its outer edge more prominent than the inner. Its anterior third presents a rough depression, for the insertion of ligaments, which constitutes a portion of the neck of the astragalus. Its *lower surface* presents two articular surfaces,

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* Ἀστϱάγαλος, *talus.*

separated from each other by a very distinct groove, directed obliquely forwards and outwards, narrower behind than before, and into which are inserted ligaments which are attached on the other hand to the calcaneum. Of these surfaces, one is posterior and external, large, concave, directed backwards and inwards; the other, anterior and internal, and slightly convex. Both are articulated with the upper surface of the calcaneum. The *anterior surface* of the astragalus is convex and rounded, and is articulated to the os scaphoides. It is formed by a very distinct prominence which the bone forms at this place, and is supported by a kind of neck. It is named the *Head* of the *Astragalus*. The *neck* of the astragalus, which is narrow above, where it presents a depression filled with adipose cellular tissue and ligaments, oblique below, where it presents a groove, into which are inserted ligaments which are connected with the calcaneum, as we have said, is very rough, uneven, perforated with a great number of vascular foramina, sinuous, and, as it were, twisted upon itself. It is longer, in fact, externally and above than inwards and downwards. Its *posterior surface* is very narrow and traversed obliquely, downwards and inwards, by a groove in which passes the tendon of the flexor longus pollicis pedis, and which presents externally a pointed eminence to which a ligament is attached. Its *outer surface* is triangular, smooth, concave from above downwards, plain and even a little convex from behind forwards, and is articulated with the fibula. The *inner surface*, rough and uneven in the greater part of its extent, which gives attachment to ligaments, presents, at the upper part, a smaller surface than that of the outer, broader before than behind, where it terminates in a point, and is articulated to the malleolus internus. It joins the upper surface of the bone nearly at a right angle.

OF THE SCAPHOID* BONE.

522. The *Scaphoid Bone (os scaphoides)*, occupies the middle and inner part of the tarsus, and is of an oval form, having its greatest diameter directed obliquely downwards and inwards. Its *anterior surface*, which is convex and smooth, is formed of three distinct surfaces, of which the inner is directed forwards and a little inwards, and is broader below than above, to be articulated with the first cuneiform bone; while the middle surface, which looks directly forwards, and is broader above than below, meets the second; and the outer, which is nearly of the same form, and inclined forwards and outwards, articulates with the third. They are separated from each other by rather indistinct angular lines. The *posterior surface* of the scaphoid bone is concave and smooth, and articulates with the head of the astragalus. Its *circumference* is rough and convex at the upper, outer, and lower parts, and pre-

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* Σκαφη, *navicula*, a boat.

sents many impressions of ligaments. Externally, it is sometimes furnished with a small surface which articulates with the os cuboides. At its lower part internally it is surmounted by a prominent and uneven tubercle, into which is inserted the tendon of the tibialis posticus.

OF THE OS CUBOIDES.

523. The *Os Cuboides* is situated at the anterior and outer part of the tarsus. It is of a cubical form, as its name, which was given it by Galen, implies; although it is in reality somewhat longer and thicker internally than to the outside. Its *upper surface*, which is covered by the extensor brevis digitorum pedis, is flat and rough. It looks outwards, and gives attachment to ligaments. The *lower surface* is divided into two parts by an eminence directed obliquely forwards and inwards, which gives attachment to the inferior calcaneo-cuboidal ligament, and which separates two depressions, of which the posterior is broader and rough, and also affords insertion to the fibres of this ligament, while the anterior is a true oblique groove in which slides the tendon of the peroneus longus. Its *anterior surface* is inclined a little outwards, and is formed of two distinct surfaces, of which the inner is square and articulates with the fourth metatarsal bone, while the outer, which is triangular, is joined to the fifth. Its *posterior surface*, which is convex from above downwards, and concave transversely, is articulated with the calcaneum. The *outer* is very narrow. There is seen upon it the commencement of the groove which extends over the lower surface, and which forms in this place a sort of pulley for the reflection of the peroneus longus. Lastly, the *inner surface*, at its posterior part, which is uneven and rough, gives attachment to ligaments, and in some cases presents a small surface which is articulated with the os scaphoides; but in the middle, it presents a rounded, smooth, and plain surface, which unites with the third cuneiform bone, and which is limited anteriorly by impressions of ligaments.

OF THE CUNEIFORM BONES.

524. The *Cuneiform Bones* occupy the anterior and inner part of the tarsus, between the scaphoid bone and the three first metatarsal bones. They are wedge-shaped, and of unequal size. They are designated by their numerical name, counting from within outwards. Sometimes also they are distinguished, according to their size, into *large*, *middle*, and *small*.

OF THE FIRST, LARGE OR INTERNAL CUNEIFORM BONE.

525. The *First Cuneiform Bone* is larger than the rest. Its vertical diameter is greater than its transverse. It is of the form of a wedge, with the base directed downwards. Its height is greatest at the fore part, and it is somewhat longer below than above. It is curved superiorly toward the second, and in surpassing it in this direction, is itself surpassed by the third, so that the three bones together form at their upper part a regularly transverse convexity. Its *anterior surface*, which is slightly convex and covered with cartilage, has the form of a crescent, with the convex edge turned inwards. It is articulated with the first metatarsal bone. The *posterior surface* is inclined a little outwards. It is triangular, smooth, and concave, and is connected with the internal articular surface of the anterior surface of the scaphoid bone. The *inner surface* is very large, nearly plain, and rough, and lies immediately under the skin. The *outer*, which is also nearly flat, presents, at its upper part, two articular surfaces, of which the anterior and smaller is articulated with the second metatarsal bone, while the posterior, which is larger, is connected with the second cuneiform bone. The lower part of this surface is uneven, and gives attachment to ligaments. The *Base* of the first cuneiform bone is convex, rough, and directed toward the sole of the foot. It gives attachment to the tendon of the tibialis anticus, and to a portion of the tendon of the tibialis posticus. It descends beneath the level of the lower part of the middle cuneiform bone, and especially beneath that of the small. Its *Summit*, which is directed upwards, is represented by a rather thin edge, which forms externally a small indistinct angle, arising from the union of the two portions of the outer surface.

OF THE SECOND OR SMALL* CUNEIFORM BONE.

526. This is the smallest of the three cuneiform bones. It appears as if wedged in between the first and the third. Its *Base*, which is quadrilateral, is directed upwards, and gives attachment to ligaments; as does its *Summit*, which is rather thin, and situated below. Its *anterior surface*, which is triangular, and slightly convex, is articulated to the second metatarsal bone. The *posterior*, which is also triangular and somewhat convex, is connected with the os scaphoides. The *inner surface*, presents at its upper part a small oblong, smooth, flat surface, which articulates with the first cuneiform bone. Inferiorly, it is rough, and gives attachment to ligaments. Lastly, the *outer surface* presents, above and behind, a smooth and somewhat concave surface, which is articulated to the third cuneiform bone. On the lower part of this surface are seen impressions for ligaments.

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* Or *Middle*, with reference to its position.

OF THE THIRD OR MIDDLE[*] CUNEIFORM BONE.

527. This bone is of intermediate size between the first and second cuneiform bones. It is situated on the outside of them, and on the inside of the os cuboides. Its *anterior surface* is flat, smooth, and triangular, and is articulated with the third metatarsal bone. The *posterior surface*, which is of the same form, inclines a little forwards, and is connected with the os scaphoides. The *inner surface* presents anteriorly a narrow surface which is articulated to the second metatarsal bone, and posteriorly another somewhat convex surface connected with the second cuneiform bone. These two surfaces are separated by a rough depression which gives attachment to ligaments. The *outer surface* is surmounted, posteriorly and above, by a flat, rounded surface, which is connected with the os cuboides; and anteriorly, by another small and almost linear surface, which articulates with the fourth metatarsal bone. The rest of this surface presents impressions of ligaments. The *Base* of the bone looks upwards and a little outwards. It is rough and slightly convex. Its *Summit*, which is directed downwards, is thick and tubercular.

528. *Structure* and *Development*. The structure is the same in all the bones of the tarsus, their interior being formed of spongy tissue, very soft, and plentifully moistened by fluids in the recent state, while the surface is invested by a very thin layer of compact tissue, which has a lamellar or fibrous appearance, and is capable of being torn asunder. The calcaneum and astragalus take their rise from two centres of ossification; all the others are developed by a single point, which, in the three cuneiform bones in particular, does not appear until after birth. The description of these bones is so short and simple, that I consider it useless to recapitulate their articulations.

IV.—OF THE METATARSAL BONES.[†]

OF THE FIRST METATARSAL BONE.

529. The *First Metatarsal Bone* is shorter and larger than the other, to the inside of which it is situated. Its *Body*, which is prismatic and triangular, presents an *upper surface*, which is convex and inclined inwards; an *inferior surface*, concave, broader at its extremities than in the middle, and covered by the flexor brevis pollicis pedis; and an *outer surface* which is also a little concave, and corresponds at its upper part to the first dorsal interosseous muscle, and below to the abductor pollicis. Of the three edges by which these surfaces are separated, two are superior,

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[*] Or *External*, with reference to its position.

[†] Μεταταρσιον: Μετα, *post*; Ταρσος, *tarsus*.

rounded, and slightly concave; the third is inferior, more prominent than the preceding, and turned a little outwards. Its *posterior* or *tarsal extremity* presents a slightly concave, oval surface, corresponding to the one which the first cuneiform bone presents at its fore part. Its circumference is bulged and uneven, and at the lower part is furnished with a tubercle, into which is inserted the tendon of the peroneus longus. Its *anterior* or *phalangeal extremity* is called the *head.* It is rounded, convex, smooth, and more prolonged downwards than upwards. In the former direction, it presents two depressions in the form of channels, which are separated by an intervening prominence, and which lodge the sesamoid bones. It is articulated to the first phalanx of the great toe. On the sides of this extremity are seen impressions for the lateral ligaments of the articulation.

OF THE SECOND METATARSAL BONE.

530. This is the longest of all the bones of this region. Its *Body,* which is elongated, narrower before than behind, presents in general a form which varies in different individuals. Its *upper surface,* is slightly convex, and is divided by a blunt edge into two parts, of which the inner gives attachment to the first dorsal interosseous muscle, and the outer to the second. Its *lower surface,* which is very narrow, concave, and connected with the abductor pollicis pedis, is covered by the two first plantar interosseous muscles. The *inner surface* is also narrow and rounded; the *outer* has nearly the same form, and like it, corresponds to an interosseous muscle. The *posterior* or *tarsal extremity* of the second metatarsal bone, which has the form of a wedge, and is jammed in, as it were, between the three cuneiform bones, presents posteriorly a triangular concave surface, which articulates with the second of these bones; internally, a flattened rough surface, on which there is observed, at the upper part, another articulating surface for the first cuneiform bone; externally, two small flat articular surfaces, surmounting impressions of ligaments, meeting at an angle, and of which the anterior is articulated with the third metatarsal bone, and the posterior with the third cuneiform. At the upper part, this extremity is terminated by a rough flattened surface, which forms its base; at the lower part, by a narrow uneven edge, which represents its summit. The *anterior* or *phalangeal extremity* of this bone, which is also named the *head,* is convex, transversely compressed, more extended above than below, and articulates with the first phalanx of the second toe. It is marked internally and externally by depressions, which give attachment to the lateral ligaments of this articulation. There is also observed upon it, at its upper part, a superficial groove, which separates the head from the rest of the bone.

OF THE THIRD METATARSAL BONE.

531. It is a little shorter than the second, but presents nearly the same form. Its *body*, which is prismatic and triangular, and a little curved inwards at its anterior part, presents a convex *superior surface*, divided into two parts by a prominent line, which gives attachment to the second and third dorsal interosseous muscles; two *lateral surfaces*, which correspond to the same muscles; and an *inferior edge*, which is thin, concave, and gives insertion to the first plantar interosseous muscle. Its *posterior* or *tarsal extremity* is nearly of the same form as that of the preceding bone. It presents posteriorly a flat triangular surface, directed inwards, which articulates with the third cuneiform bone; internally, two small surfaces, continuous posteriorly, but separated anteriorly by a slight depression, and which articulate with the second metatarsal bone; externally, a small concave surface which is connected with the fourth metatarsal bone, and which is limited below by impressions of ligaments. The base of this extremity is turned upwards, flat and rough; its summit, which looks downwards, gives attachment to ligaments. The *anterior* or *phalangeal extremity* of this bone resembles that of the preceding, and is articulated to the first phalanx of the third toe.

OF THE FOURTH METATARSAL BONE.

532. The fourth metatarsal bone has nearly the same form as the third, but is a little shorter than it. Its *Body*, which is prismatic and triangular, is curved inwards somewhat more decidedly than that of the preceding bone. Its *upper surface* is narrow and also divided into two by a prominent line. It gives attachment to the third and fourth dorsal interosseous muscles. Its *outer surface* is narrow and rounded; the *inner* presents the same disposition. The former gives attachment to the fourth dorsal interosseous muscle, the latter to the second plantar interosseous muscle, as well as the *inferior edge*, which is thin, concave, and directed a little outwards. The *Posterior* or *Tarsal Extremity* of the fourth metatarsal bone is of a cubical form, and presents posteriorly a square surface, somewhat concave, which is connected with the os cuboides; internally, two other surfaces, of which the anterior is convex, and articulates with the third metatarsal bone, and the posterior, which is very narrow, unites with the third cuneiform bone; externally, a somewhat concave surface, which articulates with the fifth metatarsal bone; superiorly and inferiorly, two rough surfaces, which give attachment to ligaments. The *Anterior* or *Phalangeal Extremity* differs in nothing from that of the other metatarsal bones. It is articulated with the first phalanx of the fourth toe.

OF THE FIFTH METATARSAL BONE.

533. Next to the first, this is the shortest of all the metatarsal bones. Its *Body*, as in most of the others, is prismatic, triangular, strongly curved inwards, and much larger posteriorly than anteriorly. Its *upper surface* is convex, and inclined outwards. The *lower* is concave, and inclined inwards. It gives attachment to the third plantar interosseous muscle, and is partly covered by the flexor brevis minimi digiti. The *inner surface*, which is narrow and convex, receives at its upper part, the fourth dorsal interosseous muscle, and, at the lower, the third plantar. The *Posterior* or *Tarsal Extremity* is very large, and of a pyramidal form. It presents, posteriorly, a triangular convex surface, directed inwards, which articulates with the os cuboides; internally, a somewhat convex surface, united to the fourth metatarsal bone; externally, a very prominent tubercle, inclined downwards, outwards and backwards, to which are attached the tendon of the peroneus brevis, and a portion of the abductor minimi digiti; superiorly and inferiorly, insertions of ligaments. The *Anterior* or *Phalangeal Extremity* is much smaller than that of the other metatarsal bones. Its convexity is more prolonged downwards and outwards. It articulates with the first phalanx of the fifth toe, and gives insertion to part of the transversalis pedis

534. *Structure* and *Development.* The metatarsal bones are precisely the same, as to structure and development, as the metacarpal. Like them, they have a medullary canal, cellular extremities, and a body chiefly composed of compact tissue. The first has an epiphysis commencing at its posterior extremity, and the other four have one at their anterior extremity.

535. *Articulations.* The first metatarsal bone articulates with the large cuneiform bone, and the first phalanx of the great toe; the second is united to the three cuneiform bones, the third metatarsal bone, and the first phalanx of the second toe; the third is connected with the third cuneiform bone, the second and fourth metatarsal bones, and the first phalanx of the corresponding toe; the fourth is articulated with the os cuboides, the third cuneiform bone, the third and fifth metatarsal bones, and the first phalanx of the fourth toe; lastly, the fifth is connected with the os cuboides, the fourth metatarsal bone, and the first phalanx of the little toe.

V.—OF THE BONES OF THE TOES.

536. The *Toes*, like the fingers, are five in number, and are distinguished individually by their numerical names, counting from within outwards. The first is also called the *Great Toe*, and the fifth is designated by the name of *Little Toe.* The first only is formed of two phalanges; all the others have three.

OF THE FIRST PHALANGES OF THE TOES.

537. These phalanges are much longer than the others. They are much more slender and rounded than the corresponding phalanges of the fingers, with the exception of that of the great toe, which is flattened and of great size. The rest gradually diminish in size. Their *Body* is very slender anteriorly, thicker behind. Its *upper surface* is convex, and corresponds to the tendons of the extensors of the toes; the *lower* is concave, especially towards the extremities, and corresponds to the tendons of the flexors. The lateral parts of this surface give attachment to the fibrous sheaths of these tendons. The *lateral surfaces* are concave, and correspond to the tendons of the interosseous muscles and lumbricales. Their *Posterior Extremity*, which is larger than the anterior, and which presents posteriorly a concave rounded surface, articulating with the head of the corresponding metatarsal bone, presents on each side a tubercle for the attachment of the lateral ligament. Their *Anterior Extremity*, which is much smaller, is formed by two condyloid prominences, which are close together above and separated below, with an intervening groove, and having their greatest convexity directed downwards. On the sides of this extremity are observed the impressions of the lateral ligaments.

OF THE SECOND PHALANGES OF THE TOES.

538. They are very short, and of a cubical form. The great toe has none. Their *upper surface* is convex in the transverse direction, concave from before backwards, and corresponds to the tendons of the extensor digitorum pedis. The *inferior surface*, which is uneven and concave, gives attachment to the tendon of the flexor brevis digitorum. The *lateral edges* are concave from before backwards, and give attachment to the fibrous sheaths of the tendons of the flexor muscles. Their *Posterior Extremity* presents a concave articular surface, of which the greatest diameter is transverse, and which is marked, in its middle part, with a vertical prominence. It is articulated with the condyles of the first phalanges. Their *Anterior Extremity* bears two small condyles, somewhat less prominent than those of the anterior extremity of the first phalanges.

OF THE THIRD PHALANGES.

539. The third or extreme phalanges are all very small. That of the great toe is much larger than the rest. Their form is somewhat pyramidal. Their *Body*, of which the *superior* and *inferior surfaces* are concave from before backwards, and convex in the

transverse direction, gives attachment at its upper and posterior part, to the tendon of the extensor communis digitorum, and sustains the nail at its upper and fore part. Inferiorly, it presents at the back part a tubercle, which receives the insertion of the tendon of the flexor communis perforans. Their *Posterior Extremity* or *Base* is much larger than the anterior. In other respects, it is similar to that of the second phalanges. The *Anterior Extremity* or *Summit* is fungiform, rounded, tubercular, and is connected with the pulp of the toes.

540. *Structure*, *Development*, and *Articulations*. The first phalanges of the toes are similar to those of the fingers, with respect to their composition and mode of growth; but the second and third are formed of cellular tissue, invested by a thin layer of compact tissue, and are only developed by two, and sometimes by a single point of ossification, on account of their smallness. When there are two of these points, the one occupies the posterior extremity, the other the body. The anterior extremity does not present an epiphysis. The first phalanges articulate with the metatarsal bones and the second phalanges; the latter with the first and third. In the great toe, the first phalanx is connected directly with the last.

OF THE SESAMOID BONES.[*]

541. The *Sesamoid Bones* are small irregular bodies, varying in number, and irregular in their occurrence, but which generally exist more numerously in the male than in the female, and which are met with in certain joints of the fingers and toes. They vary much in their form, and are composed of spongy tissue covered by a slight layer of compact tissue. They do not exist in children, and are only developed in advanced age in the tendons which surround the joint to which they belong.

542. In the hand, two are commonly met with at the anterior part of the first joint of the thumb, sometimes one or two at the corresponding joint of the fore-finger, another at that of the little finger, and one at the second joint of the thumb. It is seldom that they are observed in any of the other joints, although Morgagni mentions such an occurrence. The two first of the thumb are of an oblong form, convex anteriorly, covered with cartilage, and lodged in a groove of the inferior extremity of the first metacarpal bone. Sometimes one of them is larger than the other. They are enveloped by the fibres of the tendon of the flexor brevis muscle, while the tendon of the flexor longus passes between them.

543. In the foot there are in like manner three for the great toe. Their form is the same as those of the thumb. One is also pretty frequently found at the first joint of the second toe, and another at that of the fifth.

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[*] *Σησαμοειδέα, ob formam sesami, granis fere similem.*

544. Sesamoid bones also make their appearance in other parts of the body. Thus there is pretty frequently one at the posterior part of each condyle of the femur. In old people, another very frequently occurs beneath the os cuboides, in the tendon of the peroneus longus. Lastly, the tendon of the tibialis anticus also contains one, near its insertion into the scaphoid bone.

OF THE INFERIOR EXTREMITIES CONSIDERED IN GENERAL WITH REFERENCE TO THEIR BONES.

545. The inferior extremities are formed of a series of bones which represents a sort of column resting upon a broad basis to which it transmits the whole weight of the body. This column is as it were broken in its middle part. It in fact approaches that of the opposite side as far as the knee, after which it descends vertically, and parallel to the other. In women, however, there is always a slight inclination inwards, in the whole extent of the extremity. In general also the lower extremity presents a curvature outwards; because the outer part of the upper extremity of the tibia is never sufficiently raised to compensate the deficiency in the length of the corresponding condyle, and because the upper extremity of the tibia itself is also a little curved.

In the thigh, the column is solid and formed by a single bone. At the knee, it is of larger size. In the leg, it contracts a little, and results from the junction of two bones which are separated by an interval.

546. In describing the femur, we pointed out nearly all the circumstances which the *Thigh* presents with reference to the skeleton. Its axis is not parallel to that of the extremity in general. At the union of its body with its upper extremity it is angularly bent, and approaches the integuments at its upper and outer part, leaving internally a large space for the muscles. We observe, however, that the two femurs are by no means parallel, being separated above by the whole distance from one cotyloid cavity to the other, and coming very near each other at their lower extremity; whence it results that in their natural position, the condyles are placed at the same level, although the inner is a little longer than the outer. We also observe, with reference to the theory of fractures and dislocations, that the great trochanter, the outer condyle and the malleolus of the fibula are situated nearly in the same line in the natural position of the limb.

547. The *Leg* gradually diminishes in thickness from above downwards. It is flattened from before backwards, and from without inwards, and it is thicker internally than externally on account of the unequal size of the two bones of which it consists. The space by which the latter are separated is filled by a membranous ligament, and is very narrow below. In its whole length also

it seems narrower than the interval left between the radius and ulna.

The leg presents, at its lower part, the two malleoli or ankles. In all cases it forms an angle with the foot; but it is only when bent that it forms one with the thigh.

548. The *Foot*, which is composed of twenty-six bones very closely connected, and articulated to each other by a multitude of surfaces, forms a solid whole, of which the axis intersects, nearly at a right angle, the line of direction of the total length of the body. It is longer than broad, and is more prolonged anteriorly than posteriorly, the posterior portion of the calcaneum being in fact the only part of the foot that projects beyond the leg in the latter direction.

It is at first narrow, so long as it is formed of the calcaneum alone, but quickly enlarges when that bone unites with the astragalus, and continues so to the articulation of the phalanges with the metatarsus. It again contracts in the region of the toes.

On the inner side, from the calcaneum to the phalanges, the foot presents a concavity in which are lodged muscles, nerves and vessels, and which prevents it from touching the ground in its whole extent.

The *Back* of the foot, or its *upper surface*, is convex and inclined outwards and forwards. Its outer edge is thinner than the other. Its posterior extremity is named the *Heel*, the anterior the *Point of the foot*, and its under surface the *Sole*.

549. The *Tarsus* forms a kind of vault, the concavity of which is manifestly augmented by the groove of the inner surface of the calcaneum. The bones of which this part consists are disposed in two rows, although their arrangement is less regular than in the carpus. The astragalus and calcaneum form the posterior row; to the anterior belong the os scaphoides, os cuboides, and the three cuneiform bones.

The head of the astragalus is directed forwards; the anterior extremity of the calcaneum is turned a little inwards; the os cuboides, os scaphoides, and the three cuneiform bones, which rest upon it, are situated transversely.

550. The *Metatarsus* is composed of five bones, which are not closely connected in their whole extent, but separate as they advance toward the toes. That of the great toe is situated in a plane anterior to the others, while that of the fifth is far behind. These bones are strongly articulated to each other by their tarsal extremity; but anteriorly they are widely separated, a pretty large interval existing, in particular, between the first and second. The portion of the vault or arch of the foot formed by the metatarsus differs from that formed by the tarsus, in being less thick, and in the circumstances that the pieces of which it is composed are longer and more slender, and leave between them distinct intervals.

551. In the most perfect natural state, and especially in women, the second toe is the longest and exceeds the level of the others; the first is the next in these respects, and the rest progressively di-

minish. The first is undoubtedly the largest. But the use of shoes greatly alters the form of the feet in civilized countries. In consequence of the constraint which they impose upon them, the toes change their direction, their phalanges become irregular, and they are even frequently united together.

COMPARISON OF THE SUPERIOR AND INFERIOR EXTREMITIES.

552. The superior extremity is situated in a plane posterior to that occupied by the inferior extremity of the same side. This is satisfactorily shown by letting a line fall from the glenoid cavity to the cotyloid cavity.

The two superior extremities are separated, at their upper part, by a larger interval than that which exists between the heads of the femurs.

With respect to length and strength, the inferior extremities greatly exceed the superior. Their length forms seven-thirteenths of the total length of the body. We observe however that the hand, from the manner in which it is articulated with the forearm, presents larger dimensions, following the general axis of the limb, than the foot, which forms nearly a right angle with the leg.

The femur and humerus have a great resemblance to each other. At their upper extremity, the head and trochanters of the one correspond to the head and tuberosities of the other. The tibia and fibula have an obvious resemblance to the radius and ulna. The patella may, to a certain extent, be considered as analogous to the olecranon. The malleoli of the foot, and the styloid processes of the wrist, are also analogous parts.

But the foot and the hand are the parts that admit of the most perfect comparison. *Pes alterà manus*, it has been said, and the saying is very true. They present the same divisions, the same bones, and, to a certain degree, the same kind of motions. Individuals born without arms have been seen, who were so expert in using the foot, that they could write and lay hold of the minutest objects with it. These two parts differ, however, in certain respects.

Thus the tarsus is very different from the carpus in respect to the number, size, form and arrangement of its bones. It is articulated chiefly to the lower extremity of the tibia, while the carpus unites principally with the radius to which the fibula* is analogous. Besides, as we have already said, their mode of junction is quite different. The tarsus is the longest part of the foot; in the hand the carpus occupies very little space. All that the former has gained with respect to size and solidity, it appears to have lost with reference to mobility.

The toes are much shorter than the fingers, and present considerable differences in the structure and conformation of their phalanges.

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* Mr. Cloquet means the Tibia; and I should feel inclined to think that this most extraordinary and unaccountable error was merely an error of the press, did not the mistake run through all the editions of the original work of Mr. Cloquet.—K.

CHAPTER SECOND.

OF THE ARTICULATIONS.

I.—PRELIMINARY REMARKS.

553. The bones are not connected by a continuity of substance from one end of the body to the other, as is the case with several systems of organs, the nerves and vessels in particular. They are contiguous to each other in many of their points, and it is their mutual connection, the manner in which they meet and are fitted to each other, their mode of union, whatever it may be, that is designated by the name of *Articulation.* It is by means of articulations that the osseous system forms a whole, which constitutes the *Skeleton.*

II.—DIVISIONS OF THE ARTICULATIONS.

554. In the long bones, it is by the extremities that the articulations take place; in the broad bones, it is commonly by the edges; in the short bones, by various points of the surface.

555. The articulations are naturally divided into two general classes, according as they retain the bones together without admitting motion, or permit motion to take place.

The former, which belong peculiarly to the bones which unite to form cavities destined to protect the organs, such as the head, the pelvis, &c. are themselves subdivided into different orders, dependent upon the conformation of the surfaces which concur to form them.

Thus, these surfaces may be, 1st, Simply placed in juxtaposition, which is the case in places where the bones must preserve their mutual relations in a permanent manner, by their very position, as is observed at the base of the skull and in the articulation of most of the bones of the face, where the mechanism of the part is of itself sufficient to ensure solidity. 2dly, They are *interlocked*, if the general mechanism of the region is insufficient to maintain this solidity. They then present asperities and depressions, always of irregular size and form, which are mutually received, and are exactly fitted to each other, as is observed in the skull. This mode of union is only presented by the circumference of the flat bones, in which, on account of the narrowness of the surfaces, it is necessary that the points of contact should be multiplied. 3dly, They sometimes constitute a kind of real *implantation*, of which an evident example is presented by the reception of the teeth into their alveoli.

556. The articulations which allow the bones to move, also present two great subdivisions. In fact, their surfaces are kept in a sort of *continuity* by the disposition of some particular organ interposed between them, as is the case with respect to the bodies of the vertebræ; or they are merely *contiguous*, as in the articulations of the limbs.

557. The latter articulations do not all permit motions of an equal extent, or of the same nature. It is from this circumstance that a physiological classification of these articulations has lately been given, which differs entirely from that adopted by most anatomists,[*] but which I shall attempt to offer in the following table, in which I hope to be able to represent, in a complete and accurate manner, all that belongs to the division and differences of the articulations of bones, as well as their nomenclature.

A. Moveable Articulations, or Diarthroses.[†]

a. Surfaces intimately united by an intervening body, which constitutes AMPHIARTHROSIS.[‡]

Ex. *The junction of the bodies of the vertebræ with each other; that of the ossa pubis; the articulation of the upper part of the sternum.*

b. Surfaces not united as in the preceding case,[§]

1. And permitting motions of circumduction, or in all possible directions. This is the *orbicular*, *vague* or *hinged Diarthrosis*, which is divided into

ENARTHROSIS,[||] in which the motions are performed by means of a head received into a cavity;

Ex. *Articulation of the iliac bone and femur;*

Or by means of a cavity which revolves on a head;

Ex. *Articulation of the first phalanges of the fingers with the metacarpal bones.*

ARTHRODIA,[¶] which is formed by the contact of plain, or nearly plain surfaces, whose motions are very manifest;

Ex. *Articulation of the lower jaw;*

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[*] See Bichat, Anat. gener. tom. iii. p. 49.

[†] Διὰ *per*; ἄρθρον, *articulus.*

[‡] 'Αμφι, *utrinque*; ἄρθρον, *articulus*, mixed articulation; it is also called *continuous Diarthrosis.*

[§] This is what is also called *Contiguous Diarthrosis.*

[||] 'Εν, *in*; ἄρθρον, *articulus*; the preposition indicates a deep reception.

[¶] Αρθρωδια, *Galen, lib. de Ossibus.*

Or obscure, called by some authors the *planiform*, or *close Diarthrosis*, and which others have considered as the true *Amphiarthrosis*.
Ex. *Articulation of the bones of the carpus.*

2. Or, only permitting limited motions of opposition. This is the Ginglymus,[*] or *alternating* or *Cardiniform* Diarthrosis. It is distinguished into

Angular Ginglymus, or *Hinge*, of which the motions are commonly reduced to flexion and extension. It is called *perfect*, if these motions are absolutely the only ones allowed;
Ex. *The elbow joint;*
Or *imperfect*, if some lateral motions are also permitted.
Ex. *The knee-joint.*
Lateral Ginglymus, or Rotatory Diarthrosis, in which rotation is the only possible motion, and which is *double*, when a bone turns on another by two given points.
Ex. *The radius on the ulna;*
Or *simple*, if the motion is performed at a single point.
Ex. *Articulation of the atlas with the odontoid process.*

B. Immoveable Articulations or Synarthroses.[†]

1. Suture.[‡] The articular surfaces, more or less thick, constantly invested with a cartilaginous plate intimately united to both, receive each other by means of more or less distinct indentations. Sometimes the denticulations which form them have a contracted neck. It is this that constitutes the *Dovetail Suture.*
Ex. *Sagittal Suture.*
At other times, on the contrary, the circumference of a bone presents but few inequalities, and is sloped to receive the neighbouring bone. This is the *Squamous Suture*, in which the articular edges of the bones are fitted to each other, like the pieces of a multivalve shell.
Ex. *The temporal suture.*
2. Harmonia.[§] Here the surfaces are only in juxtaposition. They merely present rugosities, which are fitted to each other.
Ex. *Articulation of the maxillary and nasal bones with each other.*
3. Gomphosis.[||] The surfaces implanted.
Ex. *The teeth in their alveoli.*
4. Schindylesis.[¶] A plate of a bone is received into a groove of another bone, as is observed between the
Ex. *Upper edge of the vomer, and the lower surface of the sphenoid bone; between the lachrymal bone and the ascending process of the maxillary bone.*

558. The aggregate of the means by which the connection of the bones is effected, is what is called *Symphysis*;[**] and as these means vary in the greater number of cases, they being sometimes cartilages, sometimes cartilaginous ligaments, fibrous ligaments, &c. the old anatomists, taking them for the basis of their divisions, distinguished several kinds of symphyses. Thus the articulations in which cartilages are employed to keep the bones together are

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[*] Γιγγλυμος, *cardo.*

[†] Σύν, *cum*; αρθρον, *articulus*; *coarticulatio.*

[‡] *Sutura*, a seam

[§] ʽΑρμονια, ἆρω, *adapto.*

[||] Γόμφωσις; γόμφος, *clavus.*

[¶] Σχινδυλησις, *calami fissura.* v. Monro, *Osteol*, in fol. tome 1, p. 28.

[**] Συμφυσις; Συν, *cum*; φυω, *cresco*; συμφυω, *concresco.*

called *Synchondroses.*[*] These synchondroses may be only temporary, as that which exists at an early age between the sphenoid bone and the basilar process of the occipital; or they may be met with at all periods of life. The latter may permit pretty distinct motions, as is the case in particular with the sterno-costal cartilages; or are entirely fixed, as the articulations of the pelvis are, to which the name of symphyses is peculiarly applied. The articulations which are effected by means of ligaments, like that of the knee, are called *Synneuroses*;[†] those in which the bones are kept in place by muscles, as is observed in the os hyoides, are called *Syssarcoses*;[‡] those in which membranes are employed, are called *Meningoses*,[§] of which examples are presented in the skulls of children, at the places occupied by the fontanelles before the bones are completely ossified.

III.—OF THE PARTS WHICH ENTER INTO THE STRUCTURE OF THE ARTICULATIONS.

559. *Cartilages.* The surfaces by which two or more bones come into contact to form a moveable articulation, are always covered with a cartilage which forms a sort of polished crust, more or less thick, of a pearly white colour, remarkably hard and elastic, and possessed of a pliancy which greatly facilitates the play of the pieces of the articulation. This cartilage, which resembles a layer of wax imposed upon the bone at the place where it exists, is always much broader than thick. It adapts itself perfectly to the articulating parts, and adheres, by one of its surfaces, to the bony tissue in a manner as yet little understood, but extremely firm. There is, however, no continuity of substance between it and the cartilaginous parenchyma of the bones; and on removing, from a recent bone, by means of an acid, the phosphate of lime which it contains, there is perceived no intimate connection between the tissues, and the cartilage then separates spontaneously from the bone. No vessel appears to pass directly from the interior of the latter to the surface of the cartilage; and after a careful injection, it is observed, on dividing the bone longitudinally, that all the arteries lose themselves in its spongy tissue.

The surface of the cartilage opposite to the bone is exactly covered by the synovial membrane of the articulation, which gives it a smooth and polished appearance, and which adheres so closely to it, that it might be supposed to be perfectly bare. It is so disposed, that, in general, in the intermediate situation of the articulation, it corresponds in all its parts to the cartilage with which it is connected.

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[*] Συν, *cum*; χονδρος, *cartilago.*

[†] Συν, *cum*; νευρον, *nervus, ligamentum.*

[‡] Συν, *cum*: σαρξ, *caro.*

[¶] Μήνιγξ, *membrana.*

The circumference of these cartilages terminates insensibly on the bony surface, by gradually becoming thinner. We observe, however, with regard to the thickness of the cartilages, that it is much greater at the centre than at the circumference of those which cover the heads of bones, while an opposite arrangement is observed in those which cover the corresponding cavities. The thickness is uniform in the cartilages of the different articulations by planiform arthrodia, as in the carpus and tarsus.

560. It must not be supposed that the synarthrodial articulations are entirely destitute of cartilages, because they are not susceptible of motion. In all those whose surfaces present denticulations, or merely juxtaposition, there is seen a cartilaginous layer of great tenuity, continuous with the two bones which are connected, and which become thinner and more adherent as age advances, and are even very frequently, in old age, transformed into a true osseous substance. In the sutures of the skull, these cartilaginous laminæ are thinner at the inner than at the outer side of the wall.

561. The articular cartilages, which are destitute of fibrous perichondrium and visible blood-vessels, are formed of longitudinal fibres, crossed by other transverse and oblique fibres. These fibres are so closely compacted, that at first sight they seem to constitute a homogeneous whole. They are easily seen on cutting a cartilage, as they form distinct prominences on the edges of the section. The areolæ which they circumscribe are filled with a gelatinous pulpy matter, which is more abundant in children. The elasticity of this tissue is very great, especially in adult age, and is well retained in the state of death.

562. These organs remain untouched after a pretty long maceration, and resist putrefaction in a high degree. The action of a strong heat makes the cartilages curl, as it does to almost all the other animal tissues. Boiling in water gives them a yellowish tint, and then covers them with reticular cracks, which allows them to become detached in small polygonal plates, which are soon almost completely resolved into jelly. By desiccation in the open air, they become hard, horny, semi-transparent, and lose their elasticity as well as the greater part of their volume.

563. The cartilages contain cellular tissue. When they are deprived, by boiling, of the gelatine which they contain, there is obtained a kind of membranous parenchyma, which sufficiently proves its existence. They receive very minute blood-vessels, which proceed from branches situated near the articulation, and chiefly in the substance of the capsules, and which creep more or less obliquely into their substance. Although very delicate injections fully demonstrate the presence of these vessels, it appears probable that in the state of health, the greater part of those which are then seen do not contain blood, and are only filled with white fluids of a nature yet unknown. No nerves have as yet been traced into the substance of the cartilages.

564. *Ligaments.* The ligaments, which are met with in almost

all the moveable articulations, and which are yet sometimes absent, are very dense fibrous bundles, regular or irregular, round or flat, of a glistening white colour, varying much in form and size, sometimes even membranous, but always interlaced with the periosteum at their two extremities, which peculiarly distinguishes them from the tendons.* Their use is to connect the bones and cartilages together.

The fibres of the ligaments are connected by a somewhat loose cellular tissue, which frequently contains fatty flakes, especially in those whose form is irregular. These fibres are white or greyish, hard, possessed of little elasticity, but very tenacious, and capable of bearing the greatest stress. Some blood vessels and lymphatics of a very small calibre traverse them, and penetrate into their intervals by narrow fissures filled with cellular tissue; but no nerves have been discovered in them.

565. The tissue of the ligaments contains a large proportion of water. It becomes hard, transparent, elastic and brittle by desiccation, which gives it moreover a reddish or yellowish colour. By maceration, it softens and becomes flocculent at the surface long before resolving itself into mucous matter.

566. *Fibrous Capsules.* This name is given to a kind of cylindrical membranous bags, of a fibrous texture, more or less strong and thick, elastic, whitish, loose in proportion as the part is susceptible of more extensive motion, enveloped by a great quantity of cellular tissue, strengthened by tendinous fibres coming from the neighbouring muscles, and open at their two extremities, which are interlaced with the periosteum around the circumference of the upper and lower articular surfaces, in the humero-scapular and ilio-femoral articulations, the only ones in which true capsules are observed. They sometimes open to afford a passage to tendons which go to attach themselves to the bone, and are lined internally by the synovial membrane.

After a fortunate injection, the surface of these capsules is seen covered with a very distinct net work of vessels, which subdivide more and more as they approach the circumference of the cartilages, into which they send several small twigs. M. Heyligers† has observed that they also receive nerves, which is especially apparent in the articulation of the thigh, as I have had occasion to see myself.

567. Like the tissue of the ligaments, that of the capsules is with difficulty altered by maceration, retaining its appearance and structure for a long time, nor is it until after a considerable period has elapsed that its fibres separate from each other to be converted

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* According to this definition, it will be seen that many anatomists have erroneously given the name of ligaments to parts which totally differ from them in form, structure, and composition. This appellation should not therefore be applied to the folds of the mucous membrane which exist beneath the tongue, the folds of the peritoneum which sustain the liver, &c.

† *Dissert. Phys. Anat. de Fab. Int. Articul.* 8vo. Trajecti ad Rhenum. 1803, p. 15.

into a soft, whitish and homogeneous pulp. Both are dissolved into jelly in boiling water, after having first curled, and that sometimes with so much violence as to detach the surface of the bone to which they are fastened. They equally harden in the air, and acquire there the transparency of horn. Sulphuric acid reduces them to a blackish pulp, and nitric acid converts them into a yellow substance. Acetic acid swells them and reduces them to a gelatinous mass. The alkalies swell and soften them.

568. *Articular Fibro-cartilages.* Those bodies of a peculiar nature, which are still called *Inter-articular Cartilaginous Ligaments*, and which are intermediate in form and properties between the ligaments and cartilages, were formerly considered as true ligaments. They are in fact formed of a sort of hard, tenacious, dense and compact, fibrous base, in the meshes of which is deposited a true cartilaginous substance, to which are owing the white colour which characterizes them, the inorganic appearance which their section presents in several places, and the elasticity which they particularly possess. The resistance which they oppose to ruptures, and their solidity, are on the other hand derived from the nature of their base.

They are almost always met with in the interval of the surfaces of certain moveable articulations, as in the knee or jaw. There are also some of them between the bodies of the vertebræ, and these are true *Amphiarthrodial Neuro-chondroids*, according to Galen's expression. Their form is singularly variable. They commonly represent a kind of plates, generally free at their two surfaces, and occasionally perforated in the centre. They are not covered by a perichondrium.

But few blood-vessels are observed in them, and no nerves have yet been discovered. Their elasticity is very manifest. Desiccation renders them hard and brittle, without giving them a yellow tint. Reagents act upon them, as upon the two systems whose nature they seem equally to participate.

569. *Articular Synovial Membranes* or *Capsules.* These membranes, which have only been accurately described of late years, and in particular by Bichat, have the greatest resemblance to the serous membranes, with reference to their form, structure and functions. They occur in all the moveable articulations without exception, and form bags without apertures, transparent, and applied over all the parts which enter into the composition of the joint, without containing any of them. Their internal surface is free, contiguous to itself, smooth, polished, often furnished with villosities and fimbriated prolongations, and continually lubricated by an albuminous fluid of an aspect almost similar to that of the cavity of the pleura or peritoneum. Their external surface is uneven, wrinkled, attached by cellular tissue to all the neighbouring organs, the ligaments, fibro-cartilages, diarthrodial cartilages, &c., and is often seen to form a kind of small herniæ between the fibres of the capsules.

These articular synovial capsules vary much in their general aspect. There are some which represent round and simple bags, as is the case at the phalangeal articulations. Others, as in the coxo-femoral and scapulo-humeral articulations, seem traversed by a ligament or by a tendon, round which they are reflected so as to form a sheath.

These membranes are absolutely cellular, as is proved by maceration, there being no distinct fibre in them. Their tissue is denser and less pliant than that of the serous membranes. Injections demonstrate in them a great quantity of bloodvessels, which arrive at them by traversing the ligaments and fibrous capsules. No lymphatic vessels have as yet been discovered in them, but it may be presumed that they exist in great abundance. No nerve has ever been observed in them.

The synovial membranes appear entirely foreign to the solidity of the articulations; and only favour their motions by exhaling a fluid of a peculiar nature which is named Synovia,* (*Axungia articularis*, or *unguen articulare*, Soem.)

570. This fluid which is not, as was for a long time believed, produced by the mixture of the serosity of the membranes with the marrow of the bones, is whitish, viscid and transparent, of a sweetish and somewhat saline taste, and of a faint animal smell. If it be allowed to rest on being removed from the joint, it is converted into jelly. It mixes very well with water; its specific gravity is a little greater than that of water, in the proportion of 105 to 100; it lathers when agitated, and can be drawn out like the white of an egg, without being so unctuous or so consistent as it is. The action of caloric, alcohol, and mineral acids, demonstrates the existence of albumen in it, which becomes concrete under their influence. Latterly M. Orfila has shown that fibrin is one of the constituent principles of synovia, which also contains mucus and soda, the latter causing paper tinged with a vegetable blue to become green when dipped in it. M. Margueron† has moreover discovered hydrochlorate and carbonate of soda in it; but all these substances are held in solution by a great quantity of water, which forms more than three fourths of the weight of the fluid. Exposed to a moist air, the synovia loses its viscidity, becomes turbid, assumes a red or brown colour, and allows ammonia to be disengaged. By distillation it furnishes a charcoal, which, besides the two salts mentioned above, also contains phosphate of lime. There has also been observed in it an animal substance which is said to be uric acid.

The quantity of the synovia varies much in the different articulations, there being some which contain more than the others; but in general, it may be stated, that the greater the mobility of the part is, the more abundant is this fluid in it.

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* A word of obscure and recent origin, which Paracelsus appears to have first employed to designate a disease, or which may have been applied to the fluid in question on account of its bearing some distant resemblance to the albumen of an egg.

† Memoir read to the Acad. des Sciences, in 1792.

571. In all the moveable articulations, there occur certain organs of a reddish colour, varying much in their volume, figure and situation. Sometimes there are several of them together in the same articulation; frequently there is only one, which is of remarkable size, as in the ilio-femoral articulation; and it is to be observed that the more motions an articulation has to perform, the more numerous and the larger these bodies are. They are of various shapes, some being quadrangular, others semilunar, &c. Sometimes they are placed in particular cavities of the bones, sometimes merely at the circumference of the latter; but, whatever be their position, it is always such that they are completely protected from pressure when the bones move upon each other.

Rosenmuller thought he perceived, in the tissue of these bodies, secretory follicles, which Clopton Havers named *Glandulæ mucilaginosæ*,* imagining the synovia to be secreted by them, in which he was followed by Winslow, Haller, Bertin, Portal, Heyligers, &c. But most of the modern anatomists have rejected this opinion, and among those who have done so we distinguish the names of Walther, Bichat, Boyer, Beclard, &c. These do not distinguish the bodies in question from cellular tissue, as the most careful dissection discovers no traces in them of the parenchyma peculiar to glands, as no vestige of an excretory canal can be perceived in them, and as they are entirely resolved into cellular tissue by insufflation, as well as by maceration. These bodies must therefore be considered as masses of adipose tissue, whose volume varies according to the quantity of fat which they contain, and in which the arterial and venous vessels are infinitely subdivided before arriving at the membrane, with respect to which they perform the same office as the pia mater does with reference to the vessels of the brain. The meshes of these small bodies contain an oleaginous substance of a peculiar nature, and injections show that the vessels are infinitely ramified and anastomosed on their walls, in which respect they are evidently different from the cellular tissue of the rest of the body. We also observe that the synovial membrane forms above each of these alleged glands a multitude of floating fringes, variously cut on their free edges, which are particularly well seen by dissection under water, and on which Beclard has recently made very curious researches. It was these fringes that Havers considered as the excretory canals of his glands arranged alongside of each other; but, properly speaking, they are nothing but folds of the synovial capsule, which contain in their substance cellular tissue, fat and blood-vessels.

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* *Novæ Observ. de Ossibus*, &c. 12mo. Amst. 1731, p. 209.

IV.—OF THE ARTICULATIONS IN PARTICULAR.

A. ARTICULATIONS OF THE TRUNK.

a. Articulations of the Vertebral Column.

572. These articulations are very numerous and complicated, from the very circumstance that the region of the trunk to which they belong is composed of a great number of bones which touch each other by several points at once. Nevertheless, as these bones have a great resemblance to each other, the ligaments which unite them present a similar disposition, and may be described together, with the exception of those which connect the axis with the atlas.

1. COMMON ARTICULATIONS OF THE VERTEBRÆ.

573. Each vertebra, from the third cervical to the last lumbar inclusive, is placed in contact with that which precedes or follows it, by its body and articular processes; the laminæ and spinous processes of all the vertebræ being moreover connected by ligaments. There results from this, that the common articulations of the vertebræ present themselves under the appearance of an amphiarthrosis for their bodies, and of a plain arthrodia with obscure motions for their articular processes, and that they are further strengthened by a kind of accessory ligaments, capable of great resistance. We also observe that each vertebra has, on the one hand, isolated and peculiar means of union, as the ligamenta flava and the fibro-cartilages; and on the other, participates in the use of common organs, which extend at once over the whole vertebral column, or at least the greater part of it, such as the anterior and posterior vertebral ligaments, &c.

ARTICULATIONS OF THE BODIES OF THE VERTEBRÆ.

574. *Ligamentum commune anterius. (Fascia longitudinalis anterior,* Weitbrecht.*)* This ligament occupies the anterior region of the vertebral column, from the axis to the upper part of the sacrum. It is membraniform, of a very beautiful mother of pearl aspect and glistening appearance, and presents very distinct longitudinal striæ, which separate so many bundles of fibres, between which there exist small intervals, irregular as to form and position, for the passage of blood-vessels and cellular tissue. This ligament is very narrow in the neck, broader in the back, still broader in the lumbar region, and so disposed as to cover the greater part of the bodies of the vertebræ. It is thin in the cervical and lumbar regions, thicker in the back, and everywhere follows the inequalities of the vertebræ, accommodating itself to all their flexuosities. Its

anterior surface is covered, in the neck, by the pharynx and œsophagus; in the back, by the œsophagus, the aorta, the vena azygos, and the thoracic canal; in the loins, by the aorta, the vena cava inferior, the reservoir of the chyle, and a great number of lymphatic ganglions and trunks. All these parts are connected by loose cellular tissue. In the lumbar region, its fibres are strengthened by those of the pillars of the diaphragm, with which they are interlaced. Its *posterior surface* is applied against the bodies of the vertebræ and the fibro-cartilages which separate them. It is observed to contract a firmer adhesion to the latter than to the former, and that it is much more solidly fixed to the projecting edges of the body of each vertebra than to the transverse groove which the body presents. The *lateral edges* of the anterior vertebral ligament are much thinner than its middle part; they correspond, in the cervical region, to the recti capitis anteriores majores and longi colli muscles, and in the lumbar region to the psoae muscles.

On the sides of this ligament and under the longi colli muscles, there occur, in the cervical region only, and for each vertebral articulation, two small fibrous fasciculi, which are directed obliquely, from above downwards and from within outwards, from the upper vertebra to that beneath it. Their fibres are short and thin, and are frequently in a great part confounded with the fibro-cartilage over which they are applied.

The fibres which constitute this ligament do not occupy its whole length; they even have not all the same dimensions. Some of them, the superficial, cover the body of four or five vertebræ; others, which are intermediate, are lost beyond the third vertebra under those from which they have risen; the deepest are still shorter, and only go from one vertebra to that which is immediately below it. It is also to be observed that in general these fibres arise in much greater numbers from the fibro-cartilages than from the vertebræ themselves.

575. *Ligamentum commune posterius.* (*Fascia longitudinalis postica*, Weit.) This ligament seems to arise from another ligament with which it interlaces its fibres, and which is named the *occipito-axoid* ligament. It extends at the back part of the bodies of the vertebræ, from that of the axis to the sacrum. It is broader in the neck and back than in the lumbar region, where it even becomes so narrow as not to have more than two lines of transverse extent. In all parts of its course, it is broader opposite each intervertebral substance, than on the bodies of the vertebræ themselves, which gives it the form of a long band contracted at intervals. It is smooth and polished, and of a very shining pearly white. It does not present distinct bundles of fibres like the former, or intervals for the passage of vessels. It is in general denser and more compact than the anterior ligament. It is rather thin in the lumbar and cervical regions, and is thickest in the back. Its *posterior surface* is in contact with the dura mater which envelopes the spinal marrow, and is connected with it by an extremely loose filamentous cellular tissue, of a reddish colour,

not containing fat, but very susceptible of serous infiltration. This disposition is especially apparent at the lower part, for at the upper the dura mater is pretty intimately united to the ligament. The *anterior surface* corresponds to the bodies of the vertebræ and to the posterior part of the circumference of the intervertebral fibro-cartilages, and adheres much more firmly to the latter than to the former, to which it is even only attached at their upper and lower parts. In the middle, it is separated from the bone by an interval in which are lodged the vessels which ramify in the spongy tissue of the vertebra. Its *lateral edges* are in connection with the venous sinuses of the vertebral canal, and are raised to allow the vessels to pass, at the separation of the preceding ligament.

This ligament, like the anterior, is composed of superficial fibres, occupying the interval of four or five vertebræ or fibro-cartilages, and of deep fibres, extended over two vertebræ only, or even over a single vertebra and its fibro-cartilage.

576. *Inter-vertebral Fibro-cartilages. (Ligamenta intervertebralia*, Weit.*)* These organs resemble sections of cylinders, of a whitish colour, firm, and possessed of flexibility. They are situated between the bodies of the vertebræ, from the interval which separates the second and third, to that which exists between the last vertebra and the sacrum. Their form corresponds to that of the bodies of the vertebræ with which they are connected, being oval in the neck and loins, while in the dorsal region they are circular.

The fibro-cartilages of the neck and upper part of the back are much thinner than those of the lower part of the back and loins, the latter having a thickness of half an inch. But each of them has not an equal thickness in all parts of its extent. In the loins and neck, they are thinner behind than before, and the reverse in the dorsal region; which constitutes one of the principal causes of the triple curvature of the spine.

By their *upper* and *under surfaces*, the fibro-cartilages, closely adhere above and below to the corresponding surfaces of the vertebræ; and in subjects which have not exceeded twenty years, they are united to two layers of the cartilage of nutrition of these bones, with which they are pretty easily removed; but at a later period, the osseous fibres and those of the intervertebral substances are so united as no longer to be separable. Their *circumference* corresponds at the fore part to the anterior vertebral ligament, and at the back part to the posterior, contracting strong adhesions with their fibres. It forms part of the intervertebral foramina, and in the back, contributes moreover to the formation of the small articular cavities which receive the posterior extremity of the ribs.

The intervertebral fibro-cartilages are formed in their contour by very close fibres and laminæ of the nature of ligaments. They are concentric and disposed nearly vertically. The fibres of which they are composed never direct themselves perpendicularly from one vertebra to another; but the outermost ascend from left to right, and cover a layer which has an opposite direction, and which is itself applied against other layers having a different direction. These laminæ are numerous anteriorly and laterally, but rarer at the back part. They intersect each other, diminish in thickness, and leave between them wider intervals, in proportion as they approach the centre of each fibro-cartilage. Their vacuities are filled with a soft, pulpy, homogeneous viscid substance, of a greyish colour; and at the centre itself there is only a very soft, spongy, elastic areolar tissue, plentifully supplied with the substance in question. This disposition is much more apparent in the lumbar region than in any other part of the vertebral column. In children, this substance is whitish, transparent, and much less abundant than in adults, in whom it has more consistence and is of a yellowish colour. In old people, it diminishes still more in quantity, and the fibro-cartilages lose much of their thickness.

These bodies when soaked in water, swell and augment their vertical extent in a very distinct manner, frequently acquiring a whole inch of thickness; but it is especially towards the centre that the increase is effected, and if one of them is cut horizontally between two vertebræ, each portion, as Bichat observes, rises in the form of a cone which has its base toward the external laminæ of the fibro-cartilage, which also acquire a red colour on remaining for some time in water. By desiccation, on the contrary, these organs are rendered much thinner, especially in the middle part, which is then reduced to a line of thickness.

In the recent state the elasticity of these fibro-cartilages is extremely remarkable, and restores to its direction the vertebral column after it has been variously bent in a dead body. If a vertical section is made of several vertebræ, the tissue of this body expands and surpasses the level of the osseous surfaces formed by the saw. Their tenacity or power of cohesion is also very great, and even exceeds that of the bones with which they are connected.

ARTICULATIONS OF THE ARTICULAR PROCESSES.

577. In describing the vertebræ, we pointed out the form and direction of the surfaces by which their articular processes correspond to each other. These surfaces are invested with a very thin cartilaginous layer, which is covered by a small synovial bursa reflected from the one over the other. This membrane is pretty solid, and contains scarcely any synovia. It is pretty constantly covered with small bundles of ligamentous fibres, more or less separated and irregular, which proceed from the articular process of one vertebra to that of the opposite vertebra, and are more distinct in the back and loins than in the neck. At the inner part, it has connections with the neighbouring ligamentum flavum.

ARTICULATIONS OF THE LAMINÆ OF THE VERTEBRÆ.

578. *Ligamenta Flava.* These ligaments, which occupy the interlaminar spaces of the vertebræ, from that which exists between the second and third, to that which separates the last from the sacrum, and which complete the vertebral canal behind, are formed of a peculiar tissue, very strong and firm, elastic, of a yellowish colour, and composed of vertical fibres. They are more apparent at the interior than at the exterior of the vertebral canal, and each of them is divided into two portions, the one right, the other left, angularly united toward the base of the spinous process, but in such a manner as to leave between them a small fissure which is closed by cellular tissue. At the upper part of the neck, they are thin and narrow. They become thicker and broader in proportion as they descend, and in the loins acquire very considerable dimensions.

Each portion of these ligaments has a quadrilateral form, and is transversely elongated. Their *anterior surface* is connected with the dura mater of the spinal marrow, from which it is separated by a cellular tissue of which we have already had occasion to speak, (575.) It has a smooth and polished appearance, which seems to be owing to the existence of a peculiar membrane of an extremely delicate nature. The *posterior surface*, which is rough and uneven, is with difficulty perceived, especially in the dorsal region. It is partly covered by the superior vertebral lamina, and partly by the multifidus spinae. Their *upper edge* is attached to the inner surface of the laminæ of the vertebra which is situated above; the *lower edge* is fixed to the very margin of the vertebral lamina placed beneath. *Externally*, these ligaments are in contact with the synovial membrane of the articular processes, while *internally*, toward the angle which they form at their union, they are continuous, in the back and loins, with the interspinal ligaments.

They are composed of very numerous parallel fibres, closely compacted, longer on the side next the canal than on that of the vertebral grooves. Their elasticity and resistance are prodigious. Professor Dumeril considers them as being of the same nature with the posterior cervical ligament, which serves to support the head in quadrupeds, and which for this purpose requires a very great degree of strength. It is easy to separate their fibres and tear them asunder with the fingers, provided this be tried in the longitudinal direction. They contain very little cellular tissue, and are not dissolved by boiling without extreme difficulty.

ARTICULATIONS OF THE SPINOUS PROCESSES.

579. *Interspinal Ligaments.* These ligaments occupy the intervals of the spinous processes in the back and loins, but are want-

ing in the neck, where they seem to be substituted by the muscles of the same name. They represent so many small membranes, whose form varies in proportion to that of the space which they occupy, so that they are narrow and somewhat elongated in the back, while they are broad and quadrilateral in the loins. They also appear stronger and thicker, the lower their situation is in the spine. Their *surfaces*, which are *lateral*, correspond on either side of the median line, to the erector muscles of the spine generally. One of their *edges* is attached *above* to the lower edge of the upper process, another *below*, to the upper edge of that situated beneath. *Posteriorly*, they are confounded with the ligament by which the apices of the spinous processes are connected, and anteriorly with the ligamenta flava. They are composed of irregular bundles of fibres, which follow different directions, but generally proceed obliquely and in the opposite direction from the spinous ligament just spoken of and the inferior process, so as to cross each other.

580. *Ligamentum quo apices processuum spinosorum vertebrarum connectuntur.* It is situated behind the summit of the spinous processes of the dorsal and lumbar vertebræ, from the seventh cervical vertebra to the middle posterior tubercles of the sacrum. In the back, it is very narrow and much thinner than in the loins. In both regions, its fibres are closely interlaced with those of the aponeuroses of the neighbouring muscles; but they may easily be distinguished on account of their longitudinal direction. These fibres have not all the same length, but present an arrangement similar to that which we have already observed with respect to the anterior vertebral ligament: in other words, they extend to two, to three, to four, or to five spinous processes, according as they are deep-seated, intermediate, or superficial. Its *posterior surface* is covered by the skin, which strongly adheres to it by means of a dense cellular tissue. Its *anterior surface* sends fibres to the interspinal ligaments, while its *edges* confound theirs with the dorsal and lumbar aponeuroses.

581. These are not the only fibrous organs which the vertebral column presents at its surface for our examination. Weitbrecht, Soemmering and Lauth admit inter-transverse ligaments, which according to them exist between the transverse processes, from the fifth dorsal vertebra to the eleventh. But these ligaments are nothing but thin bundles of irregular fibres, which seem to be confounded with the tendons of the muscles of the vertebral grooves, and which appear destined rather to give them insertion, than to connect the bones, so that we cannot admit, with Winslow, that these ligaments are analogous to the interspinal, and represent membranes. Around each inter-vertebral foramen, there also occur circular and irregular bundles of fibres, frequently sending off a prolongation which divides the hole into two portions, and which are especially manifest in the lumbar region.

2.—ARTICULATION OF THE TWO FIRST VERTEBRÆ WITH EACH OTHER.

582. This articulation is of the kind named *lateral* or *axoidal ginglymus*, and is capable of great mobility. It takes place by several points at once, viz. by the toothlike process of the axis or dentata with the anterior arch of the atlas, and by the lateral articular surfaces of both these vertebræ, which are horizontal and much larger than those which succeed.

583. *Synovial Membranes of the Odontoid Articulation.* They are two in number, the one *anterior*, the other *posterior*. The first extends over a concave oval surface, covered with a thin cartilage, situated behind the anterior arch of the atlas, and a corresponding convex surface, which the odontoid process presents anteriorly. This capsule is very thin, transparent, a little looser above than below, and surrounded with much cellular tissue. The posterior membrane is equally thin, and enveloped with cellular tissue at its upper part and on the sides. It covers an oblong convex surface, tipped with cartilage, which exists at the posterior part of the odontoid process, and is even prolonged a little upon its sides; whence it proceeds backwards over the anterior part of the transverse ligament, to which it adheres but little, and which it renders smooth and polished. It is contiguous laterally with the synovial membrane of the occipital condyles, and even blends a little with it.

584. *Transverse* or *Cruciform Ligament.* This ligament, which consists of a thick, strong, and firm bundle of fibres, flattened from before backwards, and a little broader in the middle than at its two extremities, extends from the inner part of one of the lateral masses of the atlas to the corresponding point of the opposite side, passing behind the odontoid process. There results from this arrangement, that it describes in its passage a fourth of a circle, and forms with the anterior arch of the atlas, a sort of ring in which the odontoid process turns, or which turns upon it. Its *posterior surface*, which is convex, is covered by the occipito-axoidal ligament. The *anterior surface*, which is concave, is contiguous to the odontoid ligaments, at the odontoid process, and is a little covered by the posterior synovial capsule of the same process. From the middle part of its *inferior edge*, there is detached a small fasciculus of vertical fibres, about a line in breadth, which is attached to the posterior part of the body of the axis. From the corresponding point of its *upper edge*, there also proceeds a very distinct fasciculus of fibres, broader above than below, which ascends to attach itself to the anterior surface of the occipito-axoidal ligament, with which its fibres are confounded.* Its *extremities* are

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* Soemmering describes under the name of *Appendix Superior*, a small fibrous fasciculus, which proceeding from the same point, terminates at a line before the occipital-hole, on the basilar surface.

attached to irregular tubercles, presented by the lateral masses of the atlas.

This ligament, which is very strong, dense and thick, is composed of transverse, parallel, close fibres, commonly separated by narrow intervals, filled with cellular tissue, into two or three distinct bundles, placed above each other.

585. *Anterior Atloido-axoidal Ligament.* The lower edge of the small arch of the atlas and its middle tubercle, give rise to the fibres of this ligament, which are attached to the lower part of the base of the odontoid process, and to the fore part of the body of the axis. The latter fibres are the longest, and sometimes form a distinct rounded fasciculus, while the others represent a kind of membranous layer, which occupies the interval of the articular capsules, and even covers them a little. The ligament of which we speak has no connection anteriorly, but with the recti capitis antici majores muscles.

586. *Posterior Atloido-axoidal Ligament.* This ligament, which is of a membranous appearance, very thin and loose, is attached on the one hand to the inferior edge of the posterior arch of the atlas, and on the other to the upper edge of the lamina of the axis. *Posteriorly*, it is covered by much adipose cellular tissue, and by the obliqui capitis inferiores muscles. *Anteriorly*, it is connected with fasciculi of vertical fibres, of a yellowish colour, separated from each other by cellular tissue, having a considerable resemblance to the ligamenta flava, but attached to the inner lips of the laminæ of the axis, and to the lower edge of the posterior arch of the atlas. The dura-mater of the vertebral canal is applied over them.

587. *Synovial Membranes of the Articular Processes.* The articular surfaces by which these processes are connected, are much larger than in any of the other vertebræ, and, like them, constitute a planiform arthrodia; but it is to be observed that those of the axis are much broader than those belonging to the atlas. They are all covered by a very thin layer of cartilage, and kept in place by a synovial membrane on each side. These membranes are remarkable for their extreme looseness, which is still greater anteriorly and posteriorly than on the sides. They not only embrace the articular surfaces of the processes of the atlas, but are reflected a little over their circumference. They are a little thicker than the synovial membranes of the odontoid process. They correspond *anteriorly* to the anterior atloido-axoidal ligament; *posteriorly*, to adipose cellular tissue; *internally*, to the odontoid synovial capsules and the transverse ligament; *externally*, to the vertebral arteries, over which they are reflected so as to form a sort of sheath.

B. ARTICULATIONS OF THE THORAX.

1. STERNO-COSTAL ARTICULATIONS.

588. We already know that the first seven ribs are the only ones that are truly articulated with the sternum by the intervention of a pretty long cartilage, while those which follow them are merely joined to each other by means of the same sort of cartilage, and the two last even float loose among the muscles at their anterior extremity. These circumstances naturally lead us to divide these articulations into two orders; that of the *True* or *Sternal Ribs*, in which little motion is allowed, and that of the *False* or *Asternal Ribs*, in which the motions are more distinct.

ARTICULATIONS OF THE CARTILAGES OF THE TRUE RIBS WITH THE STERNUM.

589. The inner extremities of each of these cartilages (95) present a surface which is lodged in one of the small cavities placed upon the lateral edges of the sternum (80), and which, together with these edges, is invested with a slight layer of cartilage, the surface of which is not very smooth. Two radiated ligaments, the one *anterior*, the other *posterior*, strengthen this species of arthrodia. A very compact, and extremely thin synovial membrane, furnished with but little synovia, covers the articular surfaces. It is not in general easily perceived, but is a little more distinct in the two or three upper articulations than in those which follow, excepting, however, the first, in which there is an absolute continuity of substance between the costal cartilage and the sternum. This capsule is connected before and behind with the anterior and posterior ligaments of the articulation, and is moreover strengthened, above and below, by some irregular fibres.

590. There almost always occurs, in the articulation of the second of these cartilages, a fibrous fasciculus which proceeds from its projecting angle to the retiring angle of the sternal cavity, and which divides this articulation into two parts, which renders two synovial membranes necessary.

591. *Anterior Ligament.* This ligament is broad, thin, membranous, triangular, and composed of fibres which proceed in a radiating manner from the inner extremity of the cartilage, to be expanded over the anterior surface of the sternum, where they are interlaced with those of the ligaments of the opposite side, and of those situated immediately above and beneath, with the periosteum of the bone, and with aponeurotic fibres of the pectoralis major. The direction of the fibres of this ligament is such, that the upper fibres pass obliquely upwards, the lower obliquely downwards, and the middle fibres horizontally. They are not all of the same

length, the superficial being longer than the deep-seated, which become so much the shorter, the nearer they come to the joint. From the mutual interlacing of the fibres of all the anterior ligaments, there results a kind of membrane of considerable thickness, which entirely covers the sternum, and which is much more apparent at its lower part than above. In some subjects, it even forms at the lower part a kind of triangular plane, separate and distinct. The anterior ligament is covered anteriorly by the pectoralis major.

592. *Posterior Ligament.* It is not so thick as the preceding, and its fibres are not so apparent, although their disposition is absolutely the same. By their mutual interlacing, they form on the mediastinal surface of the sternum, a true membrane (the *membrana sterni* of some authors), as thick as that arising from the anterior ligament, but smooth, polished, without distinct fibrous fasciculi, unless it be merely a few which extend over its whole length, which would seem to indicate that it does not entirely originate from the posterior ligaments. It is traversed by a considerable number of small blood vessels.

593. *Ligament of the Ensiform Cartilage,* or *Costo-xiphoid Ligament.* Besides having the same ligaments as those of the other cartilages of the true ribs, the cartilage of the seventh is connected with the ensiform cartilage by a particular ligament, whose dimensions vary much in different subjects. This ligament generally presents itself in the form of a small elongated and very thin fasciculus, which, arising from the lower edge of the cartilage, descends obliquely inwards and expands over the anterior surface of the sternal appendage, uniting with that of the opposite side. It is covered by the rectus abdominis.

ARTICULATIONS OF THE CARTILAGES OF THE FALSE RIBS WITH EACH OTHER.

594. We have already pointed out (94) the manner in which the sixth, seventh, and eighth sterno-costal cartilages meet each other by their contiguous edges, by means of small oblong surfaces. These articular surfaces vary much as to form and extent, and are also frequently observed between the eighth and ninth cartilages. Each of these articulations is furnished with a small synovial bursa much looser and more apparent than that which exists at the point of junction of the preceding cartilages with the sternum. Each is also strengthened by oblique and irregular fibres, which proceed from one cartilage to the other, from before backwards, are much more distinct anteriorly than posteriorly, and are confounded with the perichondrium. Moreover, the inner extremities of the first three or four abdominal ribs are connected by a kind of small ligamentous cord, with the lower edge of the next cartilage above. The corresponding extremity of the cartilages of the two last ribs in gen-

eral, and of the last rib always, are connected solely with the abdominal muscles.*

2. ARTICULATIONS OF THE RIBS WITH THE VERTEBRÆ.

595. These articulations, which belong to the order of angular ginglymi, and which are extremely close, result from the junction of the heads of the ribs, invested with a thin cartilaginous lamina, with the cavities formed on the bodies of the dorsal vertebræ (87—53). These cavities, as we have already shown, belong to one vertebra only for the first, eleventh and twelfth ribs; but for all the others, they are formed on the two bodies at once of two contiguous vertebræ and on the fibro-cartilage which connects them. They are all covered with a thin layer of cartilage, which does not extend over the neighbouring spaces, and is destitute of the polished appearance which is commonly remarked in organs of this nature. There is also observed in each of them a small mass of the reddish cellular tissue which has been taken for synovial glands, together with the following ligaments.

596. *Anterior* or *Radiated Ligament.* It is not the same in all the articulations of the ribs, on account of the peculiarity which we have exposed in the preceding paragraph. In the nine which follow the first, it is formed of three flat and thin fibrous fasciculi, which are fixed separately to the two vertebræ, and the fibro-cartilage, which concur to form the articular cavity, and which, by converging, attach themselves all round the anterior part of the head of the rib, and constitute an irregularly quadrilateral fasciculus, with radiating fibres, of which the superficial are longer than the deep-seated. The small middle fasciculus which comes horizontally from the fibro-cartilage is the least distinct, and, like the two others, it leaves interstices between its fibres which give passage to blood-vessels.

The radiated ligaments of the first, eleventh and twelfth ribs, which are not thus divided, do not, however, present only a single order of fibres: part of that of the first is attached to the last cervical vertebra, and those of the two others also extend to the neighbouring vertebræ.

The *anterior surface* of these radiated ligaments is covered by the nervous branches of the thoracic ganglia of the great sympathetic, by the pleura, and, on the right side only, by the vena azygos. The *posterior surface* is applied against the articulation, for which it forms a sort of fibrous capsule, in conjunction with the middle costo-transverse ligament.

597. *Inter-articular Ligament.* It exists in the very interior of the articulation of the head of each rib, from the second to the

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* The outer extremity of the sterno-costal cartilages is intimately united to that of the ribs; but there is no ligament of any kind to keep these surfaces, which do not admit of any motion, in connection.

tenth inclusive, and is wanting in the rest. It is a small fibrous fasciculus, slightly tinged with yellow, of a very close texture, more or less thick, flattened from above downwards, short, fixed on the one hand to the prominent line which separates the two articular surfaces of the posterior extremity of the rib, and on the other to the angle of the cavity which receives it, where it is continuous with the intervertebral fibro-cartilage. It divides the articulation into two parts which have no communication with each other.

598. *Synovial Membranes.* It will readily be perceived that there must be two in the articulations in which the last mentioned ligament occurs, which naturally separates them from each other, and only permits them to be expanded over the upper or lower half of the articular surfaces; while in the other articulations these membranes are simple, and cover the whole extent of the articular surfaces, being reflected from the one to the other. These capsules are always indistinct, and contain but a very small quantity of synovia; in some cases they even seem to be wanting, on account of the great thickness of the inter-articular ligaments.

3. ARTICULATIONS OF THE RIBS WITH THE TRANSVERSE PROCESSES.

599. These articulations are formed between the tuberosity of the ribs and the summit of the transverse process of the corresponding vertebræ. All the ribs are thus articulated excepting the two last. Each of the parts mentioned presents a surface covered with a thin cartilage, and invested with a small synovial bursa, looser and more distinct than that of the preceding articulation. The presence of the synovia is also more manifest in it. The ligaments which concur to keep the parts in their respective situations are named as follows.

600. *Posterior Transverse Ligament, (Ligamentum transversarium externum,* Weit.) This ligament is of a quadrilateral form and flat, about two lines broad, with close and parallel fibres, which are a little longer below than above. It arises from the summit of each of the transverse processes of the dorsal vertebræ, and proceeds nearly transversely outwards towards the portion of the tuberosity of the corresponding rib which does not enter into the articulation. Its deep-seated fibres are shorter than the others, and it is shorter and more oblique in the upper ribs than in the lower. In fact, the last descends a little forwards; that which precedes it is horizontal, and the rest are ascending. It corresponds *anteriorly* to the articulation, and *posteriorly* to the muscles of the vertebral grooves.

601. *Middle Transverse Ligament.* This ligament is only seen when the rib is forcibly separated from the transverse process and its fibres torn asunder, or when a horizontal section of these two parts is made while they are still in their natural place. It seems

formed of a cellular substance in which there are perceived some irregular fasciculi of fibres of a reddish colour, which occupy the interval situated between the rib and the anterior surface of the corresponding transverse process.

602. *Inferior Transverse Ligament.* The first and last ribs are destitute of this ligament; and, in the others, it does not really belong to their articulation, since it does not proceed from the transverse process to be attached to the corresponding rib. It presents the appearance of a fasciculus composed of long diverging fibres, narrower above than below, broader and thinner in the lower ribs than in the upper, and always more distinct anteriorly than posteriorly. It is inserted into the lower edge of each transverse process, and descends from thence inwards, to be attached broader to the upper edge of the rib beneath, near its articulation with the body of the vertebra. In most subjects, it seems composed of two fasciculi, of which one, smaller than the preceding, crosses its direction. The latter arises immediately from the base of the process, and is attached to the head of the rib beneath. The inferior transverse ligament corresponds *anteriorly* to the intercostal nerve and vessels; *posteriorly*, to the longissimus dorsi. *Externally*, it is continuous with a thin aponeurosis of the intercostal muscles, and serves *internally* to complete an aperture, filled with cellular tissue, and traversed by the posterior branch of the corresponding intercostal nerve.

C. ARTICULATIONS OF THE HEAD.

1. ARTICULATIONS OF THE SKULL.

Articulations of the Skull with the Vertebral Column.

603. *Ligamentum nuchae.* All authors do not admit the existence of this ligament, which some do not distinguish from the aponeuroses of the muscles of the posterior part of the neck. In the large quadrupeds, in which it serves to sustain the head, it is extremely large and distinct, and resembles in its texture the ligamenta flava of the vertebræ; but in man, it is a very elongated, narrow fibrous cord, formed of pretty close parallel fibres, which it is often very difficult to distinguish from the aponeuroses of the trapezius, which are attached to it. It arises from the seventh cervical vertebra, and ascends between the trapezius, splenius and complexus, to be attached to the external occipital protuberance. From its anterior part, it furnishes a cellular prolongation, which proceeds as far as the external occipital ridge, and to the spinous processes of the cervical vertebræ; but this prolongation is entirely destitute of fibres, and has the appearance of a septum which separates the posterior cervical muscles from each other. Posteriorly, this ligament lies directly under the skin.

ARTICULATION OF THE OCCIPUT WITH THE ATLAS.

604. This articulation constitutes a very close double arthrodia, which results from the contact of the condyles of the occipital bone with the superior articular cavities of the atlas (56, 162). The surface of both these parts is equally invested with a pretty thick cartilage, which is interrupted in several points of its circumference by inequalities in which are lodged small masses of reddish cellular tissue. A *synovial* membrane, which exists on each side, lines the articular surfaces, being reflected from the one to the other. It is very loose anteriorly, because on this side it comprehends in its circuit a part of the surface of the occipital bone, while in the rest of its extent, it is confined to the circumference of the condyle. *Anteriorly*, it lines the anterior occipito-atloidal ligament; *posteriorly* and *externally*, it is in connection with much cellular tissue; *internally*, it covers the extremity of the transverse ligament, a part of the corresponding odontoid ligament, and small masses of adipose cellular tissue which have been taken for synovial glands. This articulation is further strengthened by two ligaments, the one before, the other behind, besides a great number of small irregular fasciculi of fibres.

605. *Anterior Occipito-Atloidal Ligament*, (*Membrana annuli anterioris vertebræ primæ*, Weit.) It is situated between the anterior arch of the atlas and the corresponding part of the margin of the occipital hole, and is composed of two distinct fasciculi. One of these, which is narrow, round, thick, superficial, and formed of vertical fibres, parallel to each other, has been named the *Anterior Cervical Ligament*. It descends from the basilar process to the tubercle of the anterior arch of the atlas. The other, which is much thinner, broad, and membranous, extends transversely from the outer extremity of one of the occipito-atloidal articulations to the corresponding point on the opposite side. Its tissue is dense and compact, and the fibres of which it is composed are with difficulty distinguished. Its *anterior surface* is covered by the preceding fasciculus, the recti capitis antici majores, and minores muscles, and a portion of the recti capitis laterales. It gives rise, by its sides, to a fibrous arch, of which the concavity is directed upwards, and which is attached to the fore part of the occipital condyle on the one hand, and on the other to the jugular surface of the same bone. This ligamentous arch is traversed by the pneumo-gastric and spinal accessory nerves, and by the internal jugular vein. The *posterior surface* of this ligament rests upon the odontoid process, the ligaments and synovial capsules of the articulation itself.

606. *Posterior Occipito-Atloidal Ligament*, (*Membrana annuli post. vert. primæ*, Weit.) This is broader than the last. It is formed of two laminæ placed the one before the other, which proceed together from the posterior part of the circum-

ference of the occipital hole, between the condyles, separating as they descend, and of which the anterior, thick and presenting very distinct vertical fibres, is interlaced with the dura mater of the vertebral canal; while the other, which is of a looser and apparently cellular tissue, is attached to the great arch of the atlas. Between these two laminæ there is a slight layer of cellular tissue, traversed by a great number of nervous filaments and vascular twigs, which pass through small holes formed in the midst of the fibres. The *anterior surface* of this ligament corresponds to the dura-mater; the *posterior* to the recti capitis postici majores and minores, and the obliquus superior. Its *extremities* form with the upper notches of the vertebra two apertures, through which pass the vertebral arteries and sub-occipital nerves.

ARTICULATION OF THE OCCIPUT WITH THE AXIS.

607. Here we find neither diarthrodial cartilages, nor synovial capsules to describe, on account of there not being bony surfaces adapted for sliding on each other. The connections are formed by means of a very strong ligamentous apparatus.

608. *Odontoid Ligaments*, (*Ligamenta vertebrae colli secundae alaria*, Soemm.) These are two short, thick, round, and very strong fasciculi, with parallel and close fibres, longer below than above, which represent each a sort of cone, whose truncated summits embrace the sides and apex of the odontoid process, while their bases are inserted in small uneven fossæ, formed on the inside of each condyle of the occipital bone.* Their direction is obliquely outwards and slightly upwards. They correspond *anteriorly* to a mass of cellular tissue and to the anterior occipito-atloidal ligament, and posteriorly to the occipito-axoidal ligament.

There is observed, moreover, a third ligamentous fasciculus of great firmness, which passes horizontally from one condyle to the other, forming some attachment by its middle to the summit of the odontoid process, and intermingling part of its fibres with the preceding ligament.

609. *Occipito-axoidal Ligament.* This ligament is not admitted by many authors, who speak of it as a prolongation of the common posterior vertebral ligament. We agree with Bichat in thinking that it has a separate existence, distinct from that of the fibrous organs in its vicinity. It is a kind of membrane, thicker laterally than at its middle part, which is attached superiorly in front of the occipital hole to the basilar groove, and descends within the vertebral canal, as far as the level of the body of the axis, passing behind the odontoid process. Its fibres are vertical, parallel, close, and of unequal length. The deeper fibres are attached to the upper edge of the transverse ligament; the middle ones descend as far as the posterior surface of the axis; while the more superficial

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* Soemmering gives these cones an inverse disposition.

are absolutely confounded with the posterior common vertebral ligament (575). *Anteriorly*, this ligament corresponds to the odontoid process, its ligaments, the transverse ligaments, from which it even receives an appendage (584), and the posterior part of the body of the axis. *Posteriorly*, it is pretty intimately connected with the dura-mater. It also serves to complete the empty spaces which the odontoid ligaments leave between themselves and between the bones.

ARTICULATIONS OF THE BONES OF THE SKULL WITH EACH OTHER.

610. These articulations are synarthroses which admit no kind of motion, and which constitute either sutures or harmoniæ. We have already described them at length (196—206); and have only here to mention a few additional particulars with respect to them.

They present differences, according as we examine them at the base or on the vault of the skull. In the former, the surfaces are in general merely placed in juxtaposition, broad, separated by a pretty thick layer of cartilage, especially between the sphenoid and occipital bones, between the latter bone and the temporal, &c.; while, in the latter, they present denticulations which are received by each other, are narrow, and have between them only an extremely thin cartilage, whose existence however may be proved by long maceration, or by boiling. The circumstance of this cartilage being thicker internally than at the outside of the skull (560), accounts for the sutures being sooner obliterated in old people, on the outside than on the inside of the walls of this cavity.

2. ARTICULATIONS OF THE FACE.

ARTICULATIONS OF THE BONES OF THE UPPER JAW.

611. We have already made known the manner in which the face is articulated with the skull (363), and described the different sutures which the bones of the face itself form by their union. We shall only here remark, that in the recent state all their junctions are similar in their composition to those of the skull (610); that the interlockings seem to circumscribe the face, and occupy its surface, that the unions by harmonia are placed at the centre, and that the interval between the surfaces of both orders is occupied by a more or less distinct cartilage.

ARTICULATION OF THE LOWER JAW.

612. This articulation, which belongs to the order of arthrodiæ, is double, but it is the same on both sides. The glenoid cavity of the temporal bone and the transverse process of the same bone (172, 173) serve to form it, in conjunction with the condyle of the inferior maxillary bone (294). The glenoid cavity, of which the outer extremity is a little more anterior than the inner, is only ar-

ticular in its fore part, which is covered with a very thin cartilage prolonged over the transverse process. The condyle of the jaw is equally covered with a thin cartilage, which is insensibly lost towards the neck. These surfaces are kept in connection by several ligaments.

613. *External Lateral Ligament.* This is a thin, short, and narrow fasciculus, with nearly parallel fibres connected by a dense cellular tissue. It is a little broader at its upper part than below. It is attached above to the tubercle which separates the commencement of the roots of the zygomatic process (172), and descends from thence obliquely backwards, to terminate at the outer side of the neck of the inferior maxillary bone. Its *outer surface* is covered by the skin and parotid gland; the *inner* is applied against the synovial capsules and inter-articular fibro-cartilage.

614. *Internal Lateral Ligament.* This is thinner than the outer; its length is also much greater. It arises from the spinous process of the sphenoid bone and the parts in its vicinity, and descends obliquely forwards, becoming broader and even membranous as it proceeds, and is at length attached to the inner and fore sides of the orifice of the inferior dentar canal. Its fibres are divergent, especially beneath. Its *outer surface* corresponds above with the synovial capsules and external pterygoid muscle; the internal maxillary artery passes between it and the neck of the condyle; and the inferior dentar vessels and nerve have connections with it farther down, and separate it from the branch of the lower maxillary bone. Its *inner surface* rests upon the internal pterygoid muscle, so that this ligament separates the two muscles of this name from each other.

615. *Stylo-maxillary Ligament.* This ligament appears less intended for connecting the maxillary bone with the temporal, than for multiplying the attachments of the stylo-glossus muscle. It is a mere aponeurotic cord, rather thin, which is attached above to the styloid process of the temporal bone, whence it descends towards the interstice of the angle of the jaw, where its fibres are implanted between the masseter and pterygoideus internus. It receives by its inner side a great part of the fibres of the stylo-glossus muscle.*

616. *Synovial Membranes* or *Capsules.* They are two in number, because this articulation contains in its interior an intermediate fibro-cartilage. The *upper*, after being expanded over the cartilage of the glenoid fossa and transverse process, is developed downwards over the upper surface of the fibro-cartilage; while the *lower*, after investing the inferior surface of the same organ, covers the condyle of the jaw, being a little more prolonged posteriorly than anteriorly. These two synovial capsules have no communi-

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* There is still pretty generally admitted in this articulation another ligament which is named the *Inter-maxillary*; but as Boyer remarks, it is nothing but an aponeurosis common to the buccinator and constrictor pharyngis superior muscles.

cation together, unless the fibro-cartilage is perforated at its centre, which sometimes happens. *Externally*, they correspond to the external lateral ligament; *posteriorly*, to the parotid gland; *anteriorly*, to the external pterygoid muscle; *internally*, to adipose cellular tissue. Their posterior part is very loose, and strengthened by an irregular fibrous layer, which is perforated by a great number of holes for vascular twigs.

617. *Inter-articular Fibro-cartilage.* It presents the form of a thin lamina, transversely oval, separating from each other the two synovial membranes, to which it adheres strongly by its two surfaces. Its *upper surface* is concave from before backwards, a little convex transversely at its anterior and posterior parts, and thus accommodates itself to the disposition of the glenoid cavity. The *inferior surface* is concave, and covers the condyle. Its *circumference* lies between the fold of the two synovial membranes. It adheres externally to the external lateral ligament; gives attachment anteriorly to some fibres of the external pterygoid muscle; and, posteriorly, is penetrated by a considerable number of small vessels. It is thicker throughout, and especially behind, than the middle part, which is often perforated with a hole, as we have said, (616.)

The fibres of this cartilage are concentric and very close. They are better seen at the circumference than at the centre.

D. ARTICULATIONS OF THE PELVIS.

ARTICULATIONS OF THE BONES OF THE PELVIS WITH THE VERTEBRAL COLUMN.

1. ARTICULATION OF THE SACRUM WITH THE VERTEBRÆ.

618. The articulation of the sacrum with the fifth lumbar vertebra, is in general perfectly similar to those of the vertebræ, and takes place by three different points; viz. by the oval surface which is observed at the middle of the base of the sacrum, and which is connected with the inferior surface of the body of the last vertebra, forming an amphiarthrosis; and by the two articular surfaces which are seen behind the entrance of the sacral canal, which constitute a double arthrodia with the inferior articular surfaces of the last vertebra. The means of union which are met with here are also the same as in the vertebral column, and are as follows:—A fibro-cartilage, (576); the end of the anterior and posterior common vertebral ligaments, (574, 575); an interspinal ligament, the termination of the ligament by which the apices of the spinous processes are connected, (579, 580); and, lastly, an interlaminar ligamentum flavum, (578), which descends from the laminæ of the last lumbar vertebra to the posterior part of the orifice of the sacral canal. There is also observed a synovial membrane in the arti-

culation of the articular processes of the sacrum with those of the vertebra. In other respects we have no differences to point out, and these parts require no particular description.

619. *Sacro-vertebral Ligament.* This is the only organ presented by the articulation in question, that is not equally observed in the vertebral column. It is a very short and strong fasciculus of fibres, which arising from the anterior and inferior part of the transverse process of the last vertebra, descends obliquely outwards towards the base of the sacrum, where it attaches itself, intermixing with irregular fibres placed before the sacro-iliac articulation. It rests upon the ligamentous fibres and cellular tissue *behind;* but is covered *anteriorly* by the psoas muscle.

2. ILIO-LUMBAR ARTICULATION.

620. *Ilio-lumbar Ligament.* This ligament is the only means of union which connects the fifth lumbar vertebra with the iliac bone, there being here no immediate connection between the bones. It is broad and thick internally, thin and narrow externally. Its form is triangular, and its direction horizontal. Its fibres, which are divergent, are pretty constantly separated into several fasciculi, by cellular tissue and vessels; the superior are the longest. From the summit of the transverse process of the vertebra, it passes transversely outwards to the posterior and superior iliac spine, into which it is inserted, as well as into the most remote part of the iliac crest, being moreover continued in a pointed form toward the anterior part. Its *anterior surface* is covered by the psoas magnus; the *posterior* rests upon the common mass of the muscles which occupy the vertebral grooves. Its *upper edge* corresponds to the quadratus lumborum, and the *lower* to the sacro-iliac ligaments.*

ARTICULATIONS OF THE BONES OF THE PELVIS WITH EACH OTHER.

1. SACRO-COCCYGEAL ARTICULATION.

621. This articulation has a great similarity to that of the bodies of the vertebræ with each other. It is an amphiarthrosis formed by the summit of the sacrum, which corresponds to the base of the coccyx by an oval surface. Two ligaments and a fibro-cartilage keep the surfaces in connection.

622. *Anterior Sacro-coccygeal Ligament.* It consists of a small number of irregular parallel fibres, expanded into a thin membrane, which descends from the anterior part of the sacrum

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* Not unfrequently the ilio-lumbar ligament sends a fasciculus to the transverse process of the fourth lumbar vertebra.

over the corresponding surface of the coccyx. This membrane pretty frequently occurs placed in a triangular space, bordered to the right and left by two ligaments which proceed from the sacrum in a converging direction, and at length unite upon the coccyx. Their thickness is pretty considerable. The rectum rests upon this ligament.

623. *Posterior Sacro-coccygeal Ligament.* This is the only one admitted by some anatomists. It is triangular, flat, broader above than below, and of a pearly tint. It arises from the margin of the inferior orifice of the sacral canal, and descends over the whole posterior surface of the coccyx, into which it is inserted. *Posteriorly*, this ligament receives some aponeurotic fibres from the glutæus maximus, and is covered by the integument; *anteriorly*, it covers the termination of the spinal portion of the arachnoid membrane, a portion of the sacrum, and almost the whole of the coccyx.

From the above description it will be seen that this ligament not only serves to strengthen the articulation, but also completes the sacral canal behind. Its superficial fibres are much longer than the deep-seated, and do not intersect each other, like the latter, which are very short and scarcely extend to the coccyx, to which the former only seem to be attached.

624. *Fibro-cartilage.* It differs from those placed between the bodies of the vertebræ only in being thinner, and in not having its centre so pulpy. Its laminæ, which are as numerous behind as before, are less so on the sides.

625. The pieces of which the coccyx is composed are connected by a similar fibro-cartilage; but ossification soon obliterates them, especially in men, for in women, this phenomenon is not observed, until they have passed the period of conception.

2. SACRO-ILIAC ARTICULATION.

626. This articulation, which is also named the *Sacro-Iliac Symphysis*, is a synarthrosis formed by the union of the semilunar, notched, slightly convex and uneven surfaces which we pointed out in describing the lateral surface of the sacrum (375), and the internal surface of the iliac bones (394). They are each invested by a thin cartilaginous lamina, which is, however, a little thicker on the side next the sacrum. These laminæ do not come into contact, there being placed between them a soft, yellowish substance of a nature little known, very different from synovia, and disseminated in isolated flakes. Their surface is granulated and rough in the adult only, for in children it is smooth, and even seems covered by an indistinct synovial membrane. These two surfaces are kept together by four strong ligaments, together with several irregular fibres.

627. *Posterior* or *Great Sacro-sciatic Ligament.* It is placed at the posterior and inferior part of the pelvis. It is of a triangular

form, thin, flat, narrower in the middle than at its extremities. It arises by a broad base from the posterior and inferior iliac spine, the sacro-spinal ligament, the last posterior tubercles of the sacrum, the lower part of the lateral surface of that bone, and the edge of the coccyx, and directs itself obliquely outwards, downwards, and a little forwards. As it advances, it loses much of its breadth, but its thickness increases in the same proportion. It is at length attached to the sciatic tuberosity, becoming broader a second time and intermingling with tendinous fibres of the biceps femoris and semi-tendinosus. Here there is detached a small fibrous prolongation, named by some anatomists the *Falciform Ligament*, which winds around the inner part of the tuberosity, attaches itself above it by its convex edge, and with its concave and floating edge covers the obturator internus muscle, for which it forms a sort of channel, as it ascends along the branch of the ischium (401).

The *posterior surface* of the great sacro-sciatic ligament gives attachment in its whole extent to fibres of the glutæus maximus; the *anterior* is united internally to the small sacro-sciatic ligament, and is separated from it externally by a triangular interval which gives passage to the obturator internus, and to the pudic vessels and nerve. Its fibres, which converge from the sacrum toward the iliac bone, and are more oblique as they are higher, are so disposed that at the middle of their length the inner cross the outer. They form several planes, separated from each other by cellular tissue, and between which pass pretty considerable branches of the sciatic artery.

628. *Anterior* or *Small Sacro-sciatic Ligament.* It is smaller than the preceding, before which it is situated, and presents nearly the same form. Internally it is broad, partly confounded with the posterior sacro-sciatic ligament, but fixed a little more anteriorly to the sides of the sacrum, and to a small portion of the edge of the coccyx. From this it proceeds outwards and forwards over the sciatic spine, to which it is attached, contracting and becoming thicker as it approaches its insertion. Its *posterior surface* covers the preceding ligament, and the pudic vessels and nerves; the *anterior* is connected with the ischio-coccygeus muscle.

It is composed of fibres which are so much the more horizontal the lower they are; and is divided into several distinct fasciculi which converge from the sacrum toward the sciatic spine.

629. The two sacro-sciatic ligaments separate the great sciatic notch into two holes, of which the upper and larger is traversed by the pyramidal muscle, the glutæal vessels and nerve, and the sciatic vessels and nerves, while the lower and smaller gives passage to the obturator internus, and the pudic vessels and nerve.

These two ligaments, while they serve to connect the sacrum and iliac bone, also contribute to the formation of the walls of the pelvis. Their inner edge sends towards the anus an aponeurotic expansion which supports the levator ani muscle.

630. *Inferior Sacro-iliac Ligament.* This ligament which is situated over the portion of the great sacro-sciatic ligament that comes from the crest of the iliac bones, is attached on the one hand to the posterior and superior spine of the ilium, and on the other to the lateral and posterior parts of the sacrum, opposite the third posterior sacral foramen, and externally of it. It consists of a very strong, long, flat, nearly vertical fasciculus, broader above than below, with fibres so much the longer the more superficial they are. It is covered by the glutæus maximus, which even forms some points of attachment to it, and is strengthened by a shorter and less thick fibrous fasciculus, which intermingles with it upon the sacrum, after having risen from the posterior and inferior iliac spine.

631. *Sacro-iliac Ligament.* It is very irregular, very short, and occupies posteriorly the space which the sacrum and iliac bones leave between them, before the common mass of the muscles of the vertebral grooves. The fibres which constitute it are much shorter before, near the articulation, than behind. They cross each other in a multitude of different directions, and are very close, and possessed of great firmness. They are attached on the one hand to the first eminences of the posterior surface of the sacrum, and to the sides of that bone at their upper part; and on the other, to the internal surface of the iliac tuberosity; and such is their adhesion to these parts, that if they are forcibly separated from the sacrum and iliac bone, the surface of one or other of these bones is detached along with them, without their being ruptured.

632. Besides these different ligaments, there are still several fibrous bundles which concur to unite the sacrum with the iliac bone; but they are irregularly disposed, and have nothing constant in their form or appearance. Some are situated behind the sacrum, and form a sort of membranous circle around each posterior sacral hole. Most of these are attached, by their extremities, to two separate tubercles, while their middle part is raised up so as to permit blood vessels to pass under them. The others, which only consist of some irregular fibres, expanded into membranes, are placed before the sacro-iliac symphysis, and vary much in their length and direction. They present a very shining appearance, and are confounded with the periosteum of the sacrum and iliac bones.

3. ARTICULATION OR SYMPHYSIS OF THE PUBES.

633. This articulation is formed by the contact of two slightly convex and uneven oval surfaces which the pubic portion of the iliac bones presents at the anterior and superior part of their lower edge (396). There is observed between them a fibro-cartilaginous plate, thicker anteriorly than behind and in its middle. It is white, very dense, elastic, and formed of two distinct portions, of which one belongs to the left pubis and the other to the right. But there are de-

tached from each of its portions transverse fibres, shorter, closer, and more numerous in the male than in the female, which form concentric laminæ intersecting each other, and of which the more superficial pass round the articulation, while the internal only describe a semicircle at its upper or lower part. In many subjects, and chiefly in women, it is observed that these fibrous laminæ are wanting at the posterior part of the symphysis. They are so much the broader and thicker, the nearer they are to the lower and upper part of the symphysis; their dimensions decrease in proportion as they approach the centre, and they become less apparent.

Toward the middle of these there are also commonly observed two small smooth polished oblong surfaces, covered with cartilage, moistened by a viscid fluid of a whitish or yellowish colour, and which appear lined by a very delicate synovial membrane. They generally occupy only a third of the length of the posterior half of the thickness of the symphysis. This disposition is much less apparent in the male than in the female, and it is still more distinct immediately after parturition. We observe, however, that in general the quantity of fibres, and the extent of the cartilaginous surfaces, are in inverse ratio, and that the relation between them is very variable; for sometimes the fibres predominate, and sometimes the smooth surfaces occupy almost the whole breadth of the articular surfaces of the pubes.

The fibro-cartilaginous substance which unites the bones of the pubes is much thicker anteriorly than posteriorly, where it forms a sort of prominence, very distinct in the female, and which occupies only the middle of the symphysis. It disappears above and below.

This articulation is strengthened by two ligaments.

634. *Anterior Pubic Ligament.* This ligament is an irregular fibrous expansion, partly intermingled with the aponeuroses of the abdominal muscles, partly with the periosteum of the bones of the pubes. It appears to be formed of several superimposed layers, which all pass before the articulation. The most superficial of these layers, proceeds from the upper part of the symphysis, expanding and separating into two fasciculi, to the fore part of the branches of the pubic arch. The deep fibres are transverse, and unite in their passage with the laminæ of the fibro-cartilage.

635. *Inferior Pubic* or *Triangular Ligament, (Ligamentum arcuatum.)* This is much stronger than the preceding. It is a thick and triangular bundle which occupies the upper part of the arch of the pubes, to the upper and inner part of the branches of which it is attached on either side. Its fibres, which are of a yellowish colour, very close, transverse, and a little curved so as to present their concavity below, are very short above, and are continuous with the laminæ of the symphysis. They become longer in proportion as they are lower, and are then immersed in cellular tissue. This ligament is very firm and perfectly distinct.

636. The symphysis of the pubes is further strengthened above

by various irregular fibres. There are also observed some which pass transversely over the prominence which its fibro-cartilage forms behind.

637. *Obturator Ligament, (Membrana obturans foraminis thyroidis,* Weit.) It is on account of its situation that we here describe this fibrous organ, for it does not at all belong to the articulations of the pelvis. It is a true membrane, which almost entirely closes the obturator hole, to the circumference of which it is attached, excepting at the upper part, where there remains a more or less distinct notch for the passage of the obturator vessels and nerve. Its fibres are interlaced in various directions. They are always more marked toward the notch. They form, in places, small distinct, thin and flat fasiculi. Its *anterior surface* corresponds to the obturator externus muscle, and the *posterior* to the obturator internus, both of which are in part attached to it.

B.—ARTICULATIONS OF THE BONES OF THE EXTREMITIES.

I.—ARTICULATION OF THE BONES OF THE SUPERIOR EXTREMITIES.

1. *Sterno-Clavicular Articulation.*

638. The clavicle is articulated by arthrodia with the upper extremity of the sternum, which presents a concave surface (78) for the reception of the head of that bone (439). The two articular surfaces, but especially that of the clavicle, are invested with a layer of diarthrodial cartilage, remarkable for its thickness. They do not exactly correspond in their dimensions, for the head of the clavicle exceeds in all directions, and especially above and before, the circumference of the cavity of the sternum. Several ligaments serve to strengthen this articulation, and surround it on all sides, so as to bear, in their general capacity, some resemblance to the nature of fibrous capsules, and to have their neighbouring edges nearly continuous.

639. *Anterior Sterno-clavicular Ligament.*—This is a broad fasciculus, consisting of divergent fibres, separated by vascular intervals. It is fixed by its narrow extremity to the fore part of the head of the clavicle, whence it proceeds downwards and inwards over the edges of the articular cavity of the sternum, where it is attached by its broadest extremity. By its *posterior surface* it covers the two synovial membranes, and adheres strongly to the inter-articular fibro-cartilage, and by the *anterior* corresponds to the sterno-mastoideus and the integuments.

640. *Posterior Sterno-clavicular Ligament.*—This ligament is narrower and weaker than the preceding; its fibres are also less divergent. It is attached, on the one hand to the posterior part of

the inner extremity of the clavicle, and on the other, to the posterior and superior part of the sternum, on the edges of the articular cavity. Its *anterior surface* covers the two synovial membranes, and a part of the circumference of the fibro-cartilage. The *posterior surface* is covered by the sterno-hyoideus and sterno-thyroideus muscles.

641 *Inter-clavicular Ligament.*—This name is given to a very distinct fasciculus, placed transversely above the upper extremity of the sternum, between the heads of the two clavicles. Its appearance varies in different individuals, it being sometimes thick, and sometimes thin, at one time simple, at another composed of several separate bundles. It is always flat. Its fibres, which are parallel are longer above than below, frequently separated by small apertures, and always more compact and closer in the middle than at the extremities. They are also curved, and their concavity, which is not very decided, is directed upwards. These fibres arise from the upper part of the sternal extremities of the clavicles, and are partly confounded with the aponeuroses of the anterior portions of the sterno-mastoid muscles. Frequently this ligament has only slight membraneous adhesions to the sternum, while, at other times it is strongly fixed to its periosteum and ligaments. Its *posterior surface* corresponds to the sterno-hyoidei and sterno-thyroidei muscles; the *anterior*, to the integuments. Its *upper edge* forms with the sternum a notch, through which vessels pass.

642. *Costo-clavicular Ligament.*—This ligament does not form an intimate part of the articulation of which we are treating, it being in no shape attached to the sternum. It is of a rhomboidal form, short, flat, and very strong, with dense, compact, oblique fibres, longer externally than at the inner part, and proceeds from the inner and upper part of the cartilage of the first rib, ascending obliquely backwards and forwards, to be inserted into a prominence which the lower surface of the clavicle presents internally. One of its surfaces is directed forwards and upwards, and is covered in a great part by the subclavius muscle; the other, which faces backwards and downwards, touches the subclavian vein. At its inner part it corresponds to the articulation.

643. *Inter-articular Fibro-cartilage.*—It consists of a nearly circular plate, fitted to the articular surfaces of the sternum and clavicle, between which it lies. It is thicker at its circumference than in the centre, which is sometimes perforated. The *circumference* is united to the ligaments described above, especially the anterior and posterior. Above and behind, where it is very much thicker, it is fixed to the head of the clavicle; downwards and inwards, where it is very thin, it is attached to the union of the sternum with the cartilage of the first rib, partly confounding itself with the perichondrium of the latter. The structure of this organ is perfectly similar to that which we observed in the fibro-cartilage of the temporo-maxillary articulation. Its fibres are also much more

apparent at the circumference than at the middle part, where they cannot be distinguished.

644. *Synovial Membranes.*—They are two in number, on account of the disposition of the inter-articular fibro-cartilage, which renders one insufficient. The one belongs to the clavicle and upper surface of the fibro-cartilage, the other invests the sternum and the opposite surface of the same organ. By their external surface, they adhere, in a great part of their extent, to the four ligaments described above; but in the intervals of these ligaments, they can be easily distinguished, and may even be made to form small protruding vesicles by pressing the surfaces against each other. They generally contain very little synovia. In other respects they are similar to the synovial membranes of the other articulations, and only communicate together in cases where the fibro-cartilage is perforated.

2. SCAPULO-CLAVICULAR ARTICULATION.

645. This articulation is of the kind designated by the name of *Plain Arthrodia.* The two surfaces which are presented for the purpose of forming it, the outer extremity of the clavicle (440) on the one hand, and the upper edge of the acromion (426) on the other, are covered with a slight layer of cartilage, remarkable for its little density and whiteness. There commonly occurs between them a very thin inter-articular ligament, pretty frequently narrower than the surfaces themselves, and always of a very variable form.

Two ligaments, the one superior the other inferior, belong to the articulation, which is lined by a synovial membrane; but the clavicle is also connected with the coracoid process by another very strong ligamentous fasciculus, without any contiguity of surfaces.

646. *Superior Ligament.*—It forms a broad and thick fasciculus, of a quadrilateral form, flat, shorter before than behind, which covers the whole upper part of the articulation, and which is itself covered by the interlaced aponeuroses of the deltoid muscle and trapezius. It is composed of parallel fibres, directed obliquely from within outwards, and from behind forwards, longer in proportion as they are more superior, which are attached, on the one hand, to the upper part of the outer extremity of the clavicle, and on the other to the upper part of the acromion.

647. *Inferior Ligament.*—It resembles the superior in form, and is nearly as distinct as it. Its fibres, which are laxer and less numerous, frequently leave intervals between them, and are attached to the lower edges of the two surfaces. Anteriorly, it is continuous with the preceding ligament, but is separated posteriorly from it by a space which is filled with cellular tissue. *Be-*

low, it corresponds to the supraspinatus muscle, and *above*, to the synovial capsule and to the fibro-cartilage, when it exists.

648. *Synovial Membrane.*—It contains very little synovia, and is sometimes double on account of the presence of the inter-articular fibro-cartilage. Its disposition is very easily conceived in the two cases, and its outer surface is only in contact with the two ligaments of the articulation and with cellular tissue.

649. *Coraco-clavicular Ligament.*—It is this ligament which does not belong to the scapulo-clavicular articulation. Several anatomists have considered it as double, because it is formed of two fibrous bundles, whose direction is different. Both serve equally to connect the clavicle with the coracoid process. Considered as a whole, it appears irregular, voluminous and very strong. Its two fasciculi are separated from each other, anteriorly, in a distinct manner, by an angular space which is filled with cellular tissue.

The *posterior* and *inner fasciculus*, or *conoid ligament*, has the form of a reversed cone. It is shorter than the other, with close and divergent fibres, and is attached by its base to a tuberosity which the lower surface of the clavicle presents externally, and by its summit to the broader part of the coracoid process. Its *anterior surface* is covered by the subclavius muscle, and the *posterior* by the trapezius. It is slightly confounded externally with the second fasciculus, and inferiorly with some of the fibres of the coracoid ligament (651).

The *anterior and external fasciculus*, or *trapezoid ligament*, which is placed at the distance of an inch from the scapulo-clavicular articulation, is longer and broader than the posterior. It is also less thick, and presents a quadrilateral form. Its fibres, which are shorter behind than before, are separated by small cellular spaces. It is attached superiorly to an oblique line, which proceeds from the above tuberosity to the extremity of the clavicle, and inferiorly to the inner and posterior part of the upper surface of the coracoid process. It unites posteriorly with the preceding ligament, forming a very distinct projecting angle. One of its surfaces is directed upwards and forwards, the other downwards and backwards. The first is in connection with the supra-spinatus muscle, and slightly with the acromio-coracoid ligament (652); the other with adipose cellular tissue which fills the triangular space left by the two fasciculi between them.

PROPER LIGAMENTS OF THE SCAPULA.

650. Besides the ligaments described above, the scapula is furnished with two other very distinct fibrous fasciculi, which are attached to it by their two extremities, having no connection with its articulation with the clavicle. One of these ligaments closes the

notch of the upper edge of this bone, the other is stretched between the acromion and coracoid process.

651. *Coracoid Ligament, (Ligamentum proprium posterius,* Weit.) This ligament is sometimes wanting, when the notch which it completes is converted into a hole by osseous substance. In other cases it is double. It consists of a thin and flat fasciculus, narrower at the middle than at its extremities, broader posteriorly than anteriorly, with close aponeurotic fibres, which are in part continuous with those of the coraco-clavicular ligament. It is attached on the one hand to the base of the coracoid process, on the other to the posterior part of the notch. The supra-scapular nerve passes almost always under this ligament, above which creep the vessels of the same name.

652. *Acromio-coracoid Ligament, (Ligamentum proprium anterius,* Weit.) It is triangular, broad, thin, and flat, and stretches transversely between the coracoid process and the acromion, broader at the end next the former than at the other. It is in fact attached in the whole extent of the outer edge of the coracoid process by two fasciculi, at first separated by cellular tissue, and afterwards united into a common bundle, which becomes narrower and thicker as it approaches the summit of the acromion, to which it is attached. One of the two roots of this bundle is anterior, shorter, broader and thinner, and directed transversely outwards; the other, which is posterior, longer, narrower, and thicker, is directed obliquely backwards and outwards. Both are, however, connected by a slight fibrous membrane.

The *upper surface* of the acromio-coracoid ligament is covered by the clavicle and the deltoid muscle; the *inferior* covers the supra-spinatus muscle. Its *anterior edge* is continuous with a pretty dense cellular lamina, subjacent to the deltoid muscle, and applied over the tendons of the supra-spinatus and infra-spinatus muscles. This ligament completes the kind of vault formed by the acromion and coracoid process above the head of the humerus.

3. HUMERO-SCAPULAR ARTICULATION.

653 The bony parts which concur to form this articulation are, on the one hand, the head of the humerus (448), and, on the other, the glenoid cavity of the scapula (433). Both are covered with diarthrodial cartilages, thicker at the centre of the former and at the circumference of the latter than in the rest of their extent. It is also to be remarked, that the depth and extent of the glenoid cavity are not proportional to the volume of the head of the humerus, so that a portion of this eminence is always without the cavity, and corresponds to the articular capsule.

654. *Capsular* or *Orbicular Ligament.* It surrounds the whole articulation, and constitutes the sole means of ensuring the mutual connection of its surfaces. It presents the form of a hollow conoid,

truncated, and much inflated in the middle, of which the summit embraces the contour of the glenoid cavity of the scapula, while its base is fixed around the neck of the humerus, the circumference of which has more extent than that of the glenoid cavity. Its looseness is very remarkable, and it is much longer than is necessary merely to keep the surfaces in contact, permitting them to separate from each other more than an inch. Its *outer surface* is covered, superiorly and internally, by the coraco-humeral ligament (655) and deltoid muscle; a little more externally, by the supra-spinatus, infra-spinatus, and teres minor muscles, whose tendons are firmly attached to it. Inferiorly, the long portion of the triceps extensor muscle is only separated from it by a thin layer of rather loose cellular tissue, which is also the case with the axillary vessels and nerves. Internally, it is interrupted by the passage of the tendon of the sub-scapularis muscle, which mingles part of its fibres with this ligament. From this interruption there generally results an oval aperture, of which the circumference is strengthened above and on the sides by two pretty distinct fibrous fasciculi. Its *inner surface* is attached around the glenoid cavity, beyond the glenoid ligament (656). It is sometimes interrupted internally, and as it were replaced by the tendon of the sub-scapularis muscle. Its *inferior edge* is fastened to the base of the neck of the humerus, expanding and prolonging itself considerably beneath this portion of the bone at its lower part, while at its upper it is confounded with the tendons of the supra-spinatus and infra-spinatus. Between the two tuberosities of the humerus, this edge is interrupted by the passage of the tendon of the biceps flexor muscle, and is attached to the two sides of the groove which lodges it.

This ligament is formed of fibres crossing each other in all directions, and is thicker above than any where else. The tendons of the different muscles which are inserted into the tuberosities of the humerus are in part confounded with it, and contribute in no small degree to strengthen it.

655. *Coraco-humeral* or *Accessory Ligament.* It is situated at the upper and inner part of the articulation, and is formed by a very dense fasciculus which arises from the outer edge of the coracoid process, and directing itself forwards and outwards, is attached to the anterior part of the great tuberosity of the humerus, confounding its fibres with those of the tendon of the infra-spinatus muscle. Its inner surface is intimately united to the capsule in the greater part of its extent.

656. *Glenoid Ligament.* This is a sort of fibro-cartilaginous rim, which seems intended to increase the depth of the glenoid cavity. It is especially formed by the fibres of the tendon of the long portion of the biceps muscle, which bifurcates at the upper part of this same cavity, which it embraces in the interval between its two branches. There are also distinguished in it proper fibres, which proceeding from any point of the circumference of the cavity, terminate at a more or less distant point. It presents a somewhat

prismatic and triangular form. Its thickest portion is fixed upon the contour of the cavity; its free edge is thin and sharp. The synovial membrane covers this ligament.

657. *Synovial Membrane.* After lining the glenoid cavity and the ligamentous rim which surrounds it, this membrane is reflected backwards over the neck of the scapula to reach the inner surface of the capsular ligament, which is entirely covered by it. At the place of separation of the fibres of this ligament, it is applied immediately upon the side of the tendon of the subscapularis muscle; and after arriving at the neck of the humerus, is reflected to proceed over the cartilage of the head of that bone. At the moment when this reflexion takes place, it leaves between the capsular ligament and the bone a circular empty space, and furnishes a prolongation which descends for about an inch along the bicipital groove, ascending again upon the tendon of the biceps muscle, enveloping it on all sides, to the glenoid cavity, and forming inferiorly a cul-de-sac, which prevents the synovia from flowing off. By this arrangement, the tendon of the biceps traverses the articulation freely, but is not contained in the interior of the synovial membrane.

658. At the upper part of this same articulation, there exists another synovial membrane, which extends from the capsular ligament to the vault formed by the acromion and coracoid processes, and by the acromio-coracoid ligament. It always contains a great quantity of synovia, and appears to belong as much to the supraspinatus muscle as to the articulation itself.

659. This articulation also contains small granulated, reddish, and very vascular masses of cellular tissue. They are observed collected in greater or less number at the inner part of the upper and lower attachments of the capsular ligament. The arteries and veins of such of these bodies as are situated upon the humerus come from the anterior circumflex vessels, which also diffuse over the capsule a great number of branches. The cellular grains placed on the neck of the scapula receive branches which proceed from the superior scapular vessels. Some of these latter are distributed to the capsule.

4. HUMERO-CUBITAL ARTICULATION,* OR ELBOW JOINT.

660. This articulation constitutes a perfect angular ginglimus, formed by the meeting of the superior extremities of the ulna and radius with the inferior extremity of the humerus. These different parts present in their aggregate two transverse rows of eminences and cavities, which are jammed into each other in a very close manner, and of which all the surfaces are invested with carti-

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* This articulation, which is commonly called the *Elbow*, is so designated because it is formed chiefly by the humerus and cubitus, or ulna, although the radius also enters into its composition.

lages. That of the cavity of the radius is continued thinner over the cylindrical contour of the extremity of that bone. The cartilage of the great sigmoid cavity of the ulna (460) is prolonged over the small cavity of the same name. It is interrupted at its middle part by a transverse depression, widened at its extremities, where it is converted into notches.

Four ligaments serve to keep together the surfaces of this articulation, which is lined in its whole extent by a synovial membrane.

661. *External Lateral Ligament.* This ligament, which is not very distinct from a tendon common to the muscles situated at the posterior surface of the fore-arm, and is almost confounded with that of the supinator brevis, consists of a short fibrous fasciculus, flat, triangular and vertical, broader above than below, and applied upon the synovial capsule of the articulation. Its *upper extremity* is attached to the external tuberosity of the humerus; the *lower extremity* loses itself in the annular ligament of the radius, and seems to bifurcate to be equally divided between the anterior and posterior parts of that ligament. Some of its posterior fibres pass over the annular ligament, and after mingling with the posterior ligament, are inserted into the outer edge of the ulna.

662. *Internal Lateral Ligament.* This ligament is longer, broader and stronger than the preceding, and like it is of a triangular form. But it is formed of two distinct bundles; of which the anterior is attached to the internal tuberosity of the humerus, and terminates on the inside of the coronoid process of the ulna, concealed by the tendon common to the anterior muscles of the fore-arm, and applied upon the synovial membrane, which it even pushes a little into the interior of the articulation. The other fasciculus, which is posterior, is formed of a great number of radiated fibres, which, also proceeding from the internal tuberosity of the humerus, are inserted into the inner part of the olecranon, and are connected internally with the triceps extensor and flexor carpi ulnaris muscles, and with the ulnar nerve, while externally they strengthen the synovial membrane.

663. *Anterior Ligament.* This is a kind of thin, irregular membrane, varying in its form, and composed of oblique fibres, separated from each other by intervals filled with cellular tissue. It covers nearly the whole articulation anteriorly. Its superficial fibres, which are very numerous, pass from the internal tuberosity of the humerus to the annular ligament of the radius, with which they are confounded. The middle fibres, which are vertical, arise from the humerus between its two tuberosities, and are lost among the preceding. The deep-seated fibres, which are also vertical, are collected into isolated fasciculi; they proceed from the coronoid cavity of the humerus, and gradually disappear upon the synovial membrane. The *anterior surface* of this ligament is covered by the tendon of the brachialis internus; the *posterior* is in connection with the synovial membrane, and with a mass of reddish and very

vascular cellular tissue, which has been considered as a synovial gland, and which fills up the coronoid cavity.

664. *Posterior Ligament.* This ligament can only be well seen when the fore-arm is bent upon the arm, and is much smaller than the anterior. It is formed of two separate fasciculi. One of these, which is internal, is nearly parallel to the posterior fasciculus of the internal lateral ligament, and ascending from the summit of the olecranon, is inserted into the inside of the pulley or trochlea of the humerus and the edge of its olecranal cavity. The other fasciculus, which is external, is a sort of fibrous band, extended between the two tuberosities of this bone, immediately behind the olecranal cavity. This ligament is covered by the tendon of the triceps extensor and by the anconeus, and is applied over the synovial membrane and a mass of cellular tissue, which occupies the olecranal fossa at its upper part.

665. *Synovial Membrane.* It is common to the humero-cubital articulation, and that of the two bones of the fore-arm with each other at their upper part. Applied behind the anterior ligament of the articulation, from which it is separated by a great quantity of cellular tissue, this membrane descends towards the neck of the radius, around which it forms a sort of cul-de-sac, directing itself to the inner surface of its annular ligament. It then ascends into the cavity of the head of the radius, is prolonged between it and the ulna, invests the two sigmoid cavities of the latter, gains the internal surface of the tendon of the triceps extensor, of the lateral ligaments, and of the posterior ligament, to arrive at the olecranal cavity, whence it proceeds to the different articular surfaces of the inferior extremity of the humerus, which it lines, and then arrives at the coronoid cavity, whence it finally proceeds to the point from which we have imagined it to set out. Its *external surface* is in connection with the brachialis internus, anteriorly; with the ulnar nerve, and the triceps and anconeus, posteriorly; with the internal lateral ligament and the common tendon of the anterior muscles of the fore-arm, internally; and with the external lateral ligament, and the common tendon of the posterior muscles of the fore-arm, externally.

This membrane is raised up by small adipose synovial masses, opposite the depressions which surmount the pulley and condyle of the humerus, as well as at the summit of the olecranon, around the sigmoid cavities of the ulna.

5. ARTICULATIONS OF THE ULNA WITH THE RADIUS.

666. These articulations constitute collectively a double lateral ginglymus, and are formed, above and below, by an immediate contact of the two bones of the fore-arm, which are separated in the middle, (487,) and connected solely by a fibrous membrane passing from the one to the other.

a.—UPPER RADIO-CUBITAL ARTICULATION.

667. In this articulation, it is the inner side of the circumference of the head of the radius that is received into the small sigmoid cavity of the ulna, (460.) These surfaces are invested with a cartilaginous crust, which is continuous with the cartilages of the preceding articulation. The same synovial membrane also extends to it. This articulation has only a single ligament.

668. *Annular Ligament*, (*Ligamentum orbiculare radii*, Weit.) This is a very strong, flat, fibrous band, about two lines broad, very dense, often penetrated with gelatin and having a cartilaginous appearance, with circular fibres more apparent at the extremities than in the middle part. It surrounds the superior extremity of the radius, and with the small sigmoid cavity forms a sort of ring in which the radius turns with ease. The ligament forms about two-thirds of this ring, and is attached, on the one hand, to the anterior edge of the small sigmoid cavity, and on the other, to its posterior edge. Its *outer surface* is covered by several muscles and by the external lateral ligament of the preceding articulation which unites with it. Its *inner surface* is lined by the synovial membrane. Its *upper circumference* is fixed by several of the ligaments of the humero-cubital articulation; the *lower* is free, and corresponds in the greater part of its extent to a replication of the synovial membrane in the form of a cul-de-sac; only some oblique fibres, arising from the posterior part of the ulna, beneath it, are attached to it posteriorly.

b.—MIDDLE RADIO-CUBITAL ARTICULATION.

669. *Interosseous Ligament*, (*Membrana interossea*, Weit.) This ligament and the following are the only means which nature has here employed to prevent the bones from separating. They are moreover intended to close up the interval existing between these bones, which present no contact of surfaces as in the other articulations.

The interosseous ligament fills up the space which exists between the radius and ulna, although it is not quite so long, being deficient from the humero-cubital articulation to the under part of the bicipital tuberosity, where there is nothing but an empty interval through which the posterior interosseous vessels pass. It presents itself under the form of a thin, aponeurotic, resplendent membrane, a little thicker above than below, composed of a great number of flat parallel fibrous fasciculi, placed one above the other in the same plane, and descending obliquely from the inner edge of the radius to the outer edge of the ulna. These principal fasciculi are connected by other very attenuated, downy, loose and flexible fibres, leaving in their intervals small apertures more or less apparent, which allow vessels and nervous filaments to pass from one of the surfaces of the forearm to that of the opposite side. The *two lateral edges* of this ligament are intimately confounded with the periosteum of the radius and ulna. Its *anterior surface* is covered, in its three upper fourths, by the flexor profundus digitorum and the flexor longus pollicis manus, which are partly inserted into it, and which have between them the anterior interosseous vessels; and in its lower fourth, by the pronator quadratus. Its *posterior surface* is in connection with the supinator brevis, extensor ossis metacarpi pollicis, extensor primi internodii pollicis, extensor secundi internodii pollicis, and the extensor proprius indicis. It commonly presents two or three fibrous bands which descend from the ulna towards the radius, and which consequently have an opposite direction to that of the other fibres. Lastly, this ligament, which is notched above, as we have said, is perforated at its lower part by a very distinct oval aperture, for the passage of the anterior interosseous vessels and nerve.

670. *Round Ligament*, also called the *Oblique Ligament (Chorda transversalis Cubiti*, Weit.) This ligament seems destined to replace the preceding in the upper part of the interosseous interval. It is a round fibrous cord of very small size, situated in a plane anterior to that of the interosseous ligament, following an opposite direction, and separating superiorly the flexor sublimis digitorum from the supinator brevis. It is attached above to the anterior and superior part of the ulna, beneath the insertion of the brachialis internus; whence it descends parallel to the inner edge of the tendon of the biceps muscle, and afterwards attaches itself to the radius, immediately beneath the bicipital tuberosity. It leaves between it and the radius a very distinct triangular space, filled with cellular tissue. Sometimes it is composed of two fasciculi; one of which passes behind the tendon of the biceps, and is inserted into the outside of the bicipital tuberosity.

C.—LOWER RADIO-CUBITAL ARTICULATION.

671. This articulation is formed by the reception of the head of the ulna into a concave surface which the radius presents at its lower and inner part, (455.) The two surfaces are invested by a very thin and smooth cartilage, and are merely surrounded by some irregular fibres, which strengthen the synovial membrane anteriorly and posteriorly. The principal means of union observed here is a fibro-cartilage.

672. *Triangular Fibro-cartilage, (Cartilago intermedia triangularis*, Weit.) This fibro-cartilage, which is placed transversely between the lower extremity of the radius and ulna, is thin, narrow, yellowish, and triangular, as its name implies. It is denser and more cartilaginous at its circumference than at the centre, thinner and broader externally than internally, and formed of more apparent fibres below than above. Its *upper surface*, which is concave and smooth, is contiguous to the lower part of the head of the ulna; the *lower surface*, which is also con-

cave and smooth, is in connection with the pyramidal bone. Its *anterior* and *posterior edges* are connected with the fibres of the radio-carpal articulation. Its *base* is inserted into the prominent edge which separates the carpal cavity of the lower extremity of the radius, from that which receives the ulna; or even sometimes it is only connected with it by means of the synovial membranes. Lastly, its *summit* is attached to the depression which separates the styloid process of the ulna from the articular surface of that bone.

673. *Synovial Membrane, (Membrana capsularis sacciformis,* Weit.) Its looseness is very remarkable anteriorly and posteriorly, where it is covered by some oblique and irregular fibres. It passes from the ulna to the radius, forming between them a very loose cul-de-sac, and from the latter bone is reflected over the upper surface of the preceding fibro-cartilage. The quantity of synovia which it contains is always very great.

6. RADIO-CARPAL ARTICULATION, OR WRIST JOINT.

674. This articulation, which is formed by the junction of the hand and fore-arm, is an arthrodia. The inferior extremity of the radius enters peculiarly into the formation of this articulation, of which the ulna forms but a small part. This inferior extremity of the radius, separated into two surfaces, and the inferior surface of the triangular fibro-cartilage, constitute a transversely elliptical cavity, into which is received a convex surface, inclined backwards, formed by the scaphoid, semilunar and pyramidal bones. The two first of these bones correspond to the radius, and the third to the fibro-cartilage, which separates it from the ulna. All the bony surfaces of this articulation are lined by pretty thick diarthrodial cartilages, and a very distinct synovial membrane occurs in its interior. It is strengthened by four ligaments.

675. *External Lateral Ligament.* It descends from the summit of the styloid process of the radius to the outer part of the scaphoid bone. Its fibres are divergent. The anterior, which are longer than the others, are continuous with the annular ligament of the carpus, and extend as far as the trapezium. It has a rather irregular form, but it is very strong.

676. *Internal Lateral Ligament.* From the summit of the styloid process of the ulna, it passes obliquely inwards and forwards to the inner side of the pyramidal bone, where it is attached. It sends some of its most superficial fibres to the anterior annular ligament of the carpus and to the pisiform bone. It is thicker and less broad than the preceding.

677. *Anterior Ligament.* It arises from the fore part of the lower extremity of the radius and of the styloid process of that bone, and descends inwards, to be attached to the fore part of the scaphoid, semilunar and pyramidal bones, but principally to the

semilunar. Its fibres, which are scarcely apparent at the lower part, are united at the upper into narrow and parallel strings; they form a sort of membrane which presents small apertures for the passage of vessels, and is covered by the tendons of the flexor muscles of the fingers.

678. *Posterior Ligament.* It is narrower and less strong than the anterior ligament, but its fibres are whiter and more distinct. It arises from the lower extremity of the radius, and descends obliquely inwards to be attached to the posterior part of the semilunar and pyramidal bones. It is covered by the tendons of the extensors of the fingers, and, like the anterior, is applied upon the synovial membrane.

679. *Synovial Membrane.* This membrane, which is at first extended over the convex surface presented by the bones of the carpus, as well as over the peculiar substance which connects them together, leaves those parts to proceed to the inner surface of the ligaments just described. It is even seen at various points exposed between these fibres, and when the articulation is pressed, it protrudes under the form of small vesicles. It leaves the ligaments to be expanded over the articular part of the radius and over the inferior surface of the triangular fibro-cartilage. Towards its upper parts there occur some of those cellular knots of which we have several times spoken, (571.) It always contains a considerable quantity of synovia.

In this articulation there are observed numerous small cellular and vascular grains around the small head of the ulna. They receive their vessels from the interosseous vessels. Some of them, although less developed, also occur on the contour of the cartilage of the radius.

7. ARTICULATIONS OF THE CARPAL BONES.

a.—ARTICULATIONS OF THE FIRST ROW OF CARPAL BONES.

680. We have already described the nearly plain surfaces by means of which the bones of the carpus are joined to each other. All their articulations are of the kind of arthrodiæ, and all the points by which they are in contact are covered with cartilage. There remains only to speak of the ligaments which they present, and which are similar for the three first bones of the first row, and for all those of the second. A nearly continuous fibrous layer also surrounds these bones, and ensures the solidity of their articulations.

681. *Interosseous Ligaments.* They are two very narrow layers of an apparently fibro-cartilaginous substance, dense and compact, which occur at the upper part of the interval left between the scaphoid and semilunar bones on the one hand, and between the latter and the pyramidal bone on the other. Their upper surface is

smooth and on a level with the convexity of the scaphoid and semilunar bones, and is covered by the synovial membrane of the radio-carpal articulation. The smallness of the intervals which they occupy accounts for the extreme shortness of these ligaments.

682. *Dorsal* or *Posterior Ligaments.* These are two in number, and are placed transversely behind the bones of the first row of the carpus, between the scaphoid and semilunar bones on the one hand, and on the other, between the latter bone and the pyramidal. They are in a great measure confounded with the neighbouring fibrous organs, and are continued into each other by some of their fibres. Of these the superficial are longest.

683. *Palmar* or *Anterior Ligaments.* These ligaments, which are not so strong as the dorsal, are placed deeply under the anterior radio-carpal ligament, and directing themselves transversely, are attached on the one hand to the scaphoid and semilunar bones, and on the other to the latter bone and the pyramidal. In passing from one of these bones to the other, they contract adhesions to the interosseous ligaments.

684. The pisiform bone is articulated to the pyramidal in a different manner. The rounded surface by which it corresponds to the pyramidal bone is covered with cartilage, and gives attachment, by its circumference, to a small isolated and rather loose synovial membrane, strengthened by some irregular bundles of fibres.

b.—ARTICULATIONS OF THE BONES OF THE SECOND ROW OF THE CARPUS.

685. *Dorsal* and *Palmar Ligaments.* They present the same disposition as those of the first row; but there are three of each kind which extend transversely, inwards and backwards, from the trapezium to the trapezoides, from the latter to the os magnum, and from the os magnum to the os unciforme. Of their fibres, which are parallel, the deeper are shorter than the superficial. The dorsal ligaments are more distinct than the palmar.

686. *Interosseous Ligaments.* Of these there are only two, one between the trapezoides and os magnum, and one between the os magnum and os unciforme. The first is less marked than the second, which occupies the space situated before the articular surfaces. Both are irregular fasciculi, intermingled with adipose tissue.

c.—ARTICULATION OF THE TWO ROWS OF THE CARPAL BONES WITH EACH OTHER.

687. This articulation is composed of two arthrodiæ and an enarthrosis. The contiguity of the scaphoid bone to the trapezium and trapezoides on the one hand, and on the other, that of the

pyramidal to the unciform bone, constitute the two arthrodiæ. The enarthrosis is formed by the reception of the head of the os magnum into a cavity formed by the scaphoid and semilunar bones. The surfaces by which these bones are in contact, are covered by thin cartilages, and they are kept together by ligaments.

688. *External* and *Internal Lateral Ligaments.* They are very short and appear to be continuous with the lateral ligaments of the radio-carpal articulation. The first, which is the strongest and most apparent, arises from the outer part of the scaphoid bone and terminates at that of the trapezium. The second descends from the pyramidal bone to the os unciforme.

689. *Anterior Ligament.* This ligament, which is formed of short and close fibres, is much more visible on the inside of the articulation than externally. It consists of several oblique and parallel fasciculi, which, arising from the three first bones of the first row of the carpus, direct themselves inwards and backwards, to terminate on those of the other row.

690. *Posterior Ligament.* This ligament varies much as to size and direction. Like the anterior, it is formed of several fibrous fasciculi, which arise from the posterior part of the bones of the first row to terminate on those of the second. This and the preceding have the same relations as the ligaments of the radio-carpal articulation, with which they seem to form a fibrous membrane enveloping the whole carpus.

691. *Synovial Membrane.* It lines the surfaces by means of which the two rows of the carpus are in contact, and moreover furnishes two prolongations which proceed upwards between the three first bones of the first carpal row to the interosseous ligaments. It also sends off three inferiorly, which descend between the four bones of the second carpal row, to invest the surfaces of the articulation of the carpus with the metacarpus and of the superior metacarpal articulations, terminating between the latter in small culs-de-sac. In certain parts of its passage, this membrane presents small adipose grains and prominent red dots, analogous to the synovial fringes. It also occasionally leaves the articular surfaces: thus it entirely covers the neck of the os magnum behind. It also lines the inner surface of the ligaments of all the articulations, between which it establishes a communication. If we except the pisiform bone, a single synovial membrane therefore is common to all the surfaces by which the bones of the carpus are articulated together.

692. *Ligaments of the Pisiform Bone.* They are two in number, and are very strong and distinct. They arise from the lower part of the pisiform bone, and are situated in a plane much anterior to that of the other ligaments of the carpus. One is external, and goes to the process of the unciform bone; the other, which is internal, separates from the preceding, and terminates at the upper part of the fifth metacarpal bone. They complete the channel in which the tendons of the flexors of the fingers pass, and are in part confounded with the tendons of the flexor carpi ulnaris and abductor

minimi digiti, which, conjointly with them, keep the pisiform bone in its place.

8. ARTICULATIONS OF THE CARPAL WITH THE METACARPAL BONES.

a.—ARTICULATION OF THE TRAPEZIUM WITH THE FIRST METACARPAL BONE.

693. This articulation is an arthrodia. We have already described its surfaces, (467—472), which are covered with a cartilaginous substance, and lined by a rather loose synovial membrane, which passes from the one to the other.

694. *Capsular Ligament.* This is the only ligament which the articulation presents. It is formed of longitudinal fibres, more distinct externally and behind than in the other directions, and passes from the circumference of the upper extremity of the metacarpal bone to that of the articular surface of the trapezium. They leave separations between them, through which the synovial capsule, which lines their inner surface, is perceived. This articulation is also much strengthened by the muscles of the thumb.

b.—ARTICULATIONS OF THE FOUR LAST METACARPAL BONES WITH THE CARPUS.

695. We have already described the surfaces which constitute these articulations, and the synovial membrane which invests their cartilages, (691.) They only present two kinds of ligaments, anterior and posterior.

696. *Dorsal* or *Posterior Ligaments.* They descend from the posterior surface of the bones of the second carpal row to the four last metacarpal bones. The trapezium and trapezoides send each one to the second of these bones. The os magnum furnishes one to the third. The fourth has two, of which one comes from the os magnum, the other from the os unciforme. The latter bone gives rise to the single ligament which belongs to the fifth metacarpal bone. All these small fasciculi are very short, flat, quadrilateral, thin and very compact. They leave between them spaces through which pass blood-vessels.

697. *Palmar* or *Anterior Ligaments.* They are much less distinct than the posterior, but in other respects present exactly the same arrangement. The third metacarpal bone is the only one that exhibits any difference. It is connected with the trapezium by two superficial ligaments, situated above the sheath of the tendon of the flexor carpi radialis, and by a deep ligament situated beneath that sheath. It is also connected with the unciform bone by a particular fasciculus.

9. ARTICULATION OF THE METACARPAL BONES WITH EACH OTHER.

698. The first metacarpal bone is isolated. The others touch each other at their upper part by small surfaces covered with cartilage, and already described, as well as the synovial capsule (691) which invests them. The anterior surfaces of the four by which the third and fourth metacarpal bones are united, are the only ones for which there exists a small synovial bag. *Dorsal* and *Palmar Ligaments*, to the number of three on each side, having a transverse direction, not very distinct from each other, especially before, strengthen the articulations of the four last metacarpal bones, which have also between them at their upper part, short and dense interosseous ligaments, placed immediately under the culs-de-sac of the synovial membrane.

699. *Transverse* and *Inferior Metacarpal Ligament*. This is a fibrous band, about two lines broad, stretched transversely before the lower extremities of the last four metacarpal bones, which are not in direct contact with each other. Its *anterior surface* is marked with four depressions which correspond to the passage of the tendons of the flexors of the fingers, and whose sides are continuous with the sheaths of these tendons. It is moreover covered by the lumbricales muscles and by the vessels and nerves of the fingers. Its posterior surface is intimately connected with the ligaments of the metacarpo-phalangeal articulations, and corresponds to the tendons of the interosseous muscles. The fibres of this ligament are transverse. The superficial, which are longer, embrace the heads of the four metacarpal bones. The deeper, which are shorter, only go from one bone to the other.

10. ARTICULATIONS OF THE METACARPAL BONES WITH THE PHALANGES.

700. These articulations are formed by the reception of the heads of the metacarpal bones into a concave and superficial surface, presented by the superior extremities of the first phalanges of the five fingers. The surfaces are equally covered with cartilage, but those of the phalanges are much less extended than those of the metacarpal bones. An anterior ligament, and two lateral ligaments, serve to strengthen each of these articulations, which are invested with a synovial membrane.

701. *Anterior Ligament*. Bichat was the first anatomist who gave a description of this ligament, which is a kind of fibrous half ring, embracing the anterior part of each articulation. On each side, it is attached to the metacarpal bone, before the lateral ligaments; and anteriorly, it partly confounds its fibres with those of the transverse and inferior metacarpal ligament, and with those of

the sheath of the flexor muscles of the fingers. From this disposition it is formed of two curved planes, meeting each other by their convexity, of which one corresponds to the tendon and the other to the articulation. It is in the substance of this ligament that, in the thumb, are developed the two small sesamoid bones between which passes the tendon of the flexor longus proprius pollicis.

702. *Lateral Ligaments.* They arise from the lateral parts of the head of each metacarpal bone, behind the preceding, and in a small special depression, and descend obliquely forward, to be attached to the two sides of the upper extremity of the phalanx. They are thick, broader above than below, rounded, and composed of longitudinal, parallel and very numerous fibres. Externally the collateral vessels and nerves of the fingers run along them, and internally they are covered by the synovial membrane.

703. *Synovial Membrane.* It is at first expanded in a small space at the fore part of the cartilaginous surface of the metacarpal bones, and then directs itself behind the anterior ligament and on the inside of the lateral ligaments, whence it gains the articular surface of the phalanx. After this it forms a very loose bag, free in a great part of its extent, beneath the tendon of the extensor muscle, and lastly covers the head of the metacarpal bone.

11. ARTICULATIONS OF THE PHALANGES.

704. The articulations of the phalanges with each other are perfect angular ginglymi, and are all very much alike in respect to their articular surfaces and ligaments. The thumb has only one, while each of the other fingers has two. The condyles of the lower extremity of the first and second phalanges are crusted with cartilage, as well as the corresponding cavities of the upper extremity of the second and third. Each of these articulations has an anterior ligament, two lateral ligaments, and a synovial capsule. The *anterior ligament*, which is of the same form as that of the preceding articulation, is attached to the two sides of the extremity of the phalanx above, and receives anteriorly a great number of dense and glistening fibres, which proceed from the sheath of the flexor tendons. It is less marked in the first than in the last phalangeal articulation. The *lateral ligaments* are precisely similar to those of the articulation of the metacarpus and first phalanx, differing only in being inserted above into a phalanx. Lastly, the *synovial membrane* also resembles that of the above mentioned articulation. It is intimately connected posteriorly with the tendon of the extensor digitorum in the last articulation.

II.—ARTICULATIONS OF THE BONES OF THE INFERIOR EXTREMITIES.

1. ILIO-FEMORAL ARTICULATION, OR HIP JOINT.

705. This articulation is an enarthrosis, resulting from the con-

tact of the head of the femur (494) with the cotyloid cavity of the iliac bone (391), the former however not being entirely received by the latter, but presenting a portion of its extent beyond the edge of the cavity. The two surfaces are covered by a very distinct diarthrodial cartilage. That of the head of the femur is much thinner at its circumference than in the middle, where it is interrupted by a depression which gives attachment to the inter-articular ligament. The cartilage of the cotyloid cavity presents the reverse arrangement, and terminates at the sort of impression which it presents in its deepest part. This articulation is furnished with a synovial membrane, a capsular ligament, an inter-articular ligament, and a cotyloid ligament.

706. *Capsular Ligament.* (*Membrana capsularis*, Weit.) This is the strongest, thickest, and largest of the capsular ligaments. It embraces the whole articulation, and extends from the margin of the cotyloid cavity to the base of the neck of the femur, directing itself downwards and outwards. It is not so loose as the capsular ligament of the humerus, to which it has in many respects a great resemblance; nor is it perforated by a tendon. Its thickness is very considerable, especially at the fore and upper part, where it is sensibly augmented by a fibrous fasciculus which descends from the anterior and inferior spine of the iliac bone, confounds itself with the capsule, and terminates at the anterior line of the base of the neck of the femur, becoming much broadened. The thickness is moderate at the inner and posterior parts of this ligament, whose structure is not easily discovered, and the direction of whose fibres is very irregular.

Internally, these fibres are often sufficiently separated from each other to allow the synovial membrane to be seen between them, and yet in this direction they are strengthened by some detached fibres from the upper part of the obturator hole. Near its attachment to the neck of the bone, the capsule is perforated, especially at its fore part, with a great number of apertures which allow vessels to penetrate.

707. The *Outer Surface* of the capsular ligament of the hip joint is covered anteriorly by the rectus femoris, psoas and iliacus muscles. A particular synovial membrane separates it from the united tendons of the two latter muscles. Internally, the obturator externus and pectineus, lie over it; posteriorly, it rests upon the quadratus femoris, gemelli, pyriformis and obturator internus; and above, is subjacent to the glutæus minimus, which adheres pretty closely to it. Its *Inner Surface* is entirely invested by the articular synovial membrane.

Its *Upper Circumference* is attached to the margin of the cotyloid cavity, from the cotyloid ligament to two or three lines beyond; and at the level of the inferior notch is attached to this ligament itself. It is also connected by a particular fasciculus to the anterior and inferior tubercle of the ilium, and by some fibres to the edge of the obturator foramen, as we have already said. It ascends perceptibly higher at the outside than internally, and is strengthened in a great part of its extent, above and behind, by the termination of the curved tendon of the rectus femoris, which even passes to its inner surface. The *Inferior Circumference* is closely fixed around the base of the neck of the femur. It descends lower at the outside than internally, where it sometimes does not pass beyond the middle of the neck of the bone, and is limited anteriorly and posteriorly by the two oblique lines of the neck, and by the small trochanter below and the greater above.

708. *Round Ligament of the Head of the Femur*, or *Inter-articular Ligament.* This is a flat, triangular fasciculus of fibres, extended from the extremities of the inferior notch of the cotyloid cavity to the rough depression of the head of the femur, and enveloped by a very loose sheath of the synovial membrane. Its *inner surface*, which is slightly directed upwards, is contiguous to the cellular mass which occupies the bottom of the cotyloid cavity. The *outer surface*, which looks a little downwards, is applied against the head of the femur. Its *base* is bifurcated, that is to say, it is formed of two flattened bands, of which the upper and smaller comes from the corresponding extremity of the cotyloid notch, internally of the ligament of the same name, while the inferior, which is larger, comes from that of the opposite side. These two bands are united by a fibrous membrane, and are confounded together towards the head of the femur.

This ligament, which was first described by Vesalius, is sometimes wanting.

709. *Cotyloid Ligament.* The circumference of the cotyloid cavity, which is of itself very prominent, is further eked out by means of this fibro-cartilaginous rim which surmounts it, and which renders it perfectly regular, by closing up the three notches observed in it. It resembles the glenoid ligament of the shoulder joint, but is stronger and larger. It is applied upon the bone by a base about three lines broad, and is terminated, in the other direction, by a free and sharp edge, inclined a little inwards, and embracing the circumference of the head of the femur. This ligament is broader at the level of the notches of the cavity than in their intervals, and is not continuous with the diarthrodial cartilage, there existing a very distinct circular groove between them. Its two *surfaces* are lined by the synovial membrane; but the *outer* is contiguous to the capsular ligament, and the *inner* to the head of the femur. At the level of the notch of the cavity, it passes from one of its extremities to the other, and is thus transformed into a true hole.

It is composed of fibres which arise externally from the circumference of the cotyloid cavity, incline a little towards its interior, and terminate on the inside of this same circumference, at a greater or less distance from it. These fibres are very close and compact, and are joined externally by some of the fibres of the curved tendon of the rectus femoris.

710. The cotyloid ligament is not the only fibrous organ which contributes to convert the cotyloid notch into a hole, it being assisted in this by two bundles of fibres which are attached beneath it, to the two sides of that notch, forming two planes which cross each other. The deeper of these planes comes from the upper side, and is partly attached to the lower, where it is confounded with the cotyloid ligament; the other, which is superficial, ascends towards the upper part of the notch, and is also confounded with the same ligament.

711. *Synovial Membrane.* From being at first expanded over the cartilage of the head of the femur, it is continued over a part of the neck of that bone, where it invests a sort of dense, thick membrane with longitudinal and separated fibres, which constitutes the periosteum of the neck. At the base of this neck, it is reflected over the capsular ligament, which it lines in its whole extent. Arrived at the circumference of the cotyloid cavity, it passes over the two surfaces of its fibro-cartilaginous rim, enters into its anterior, covers the reddish cellular tissue which occupies its bottom, adheres strongly to it, and lastly ascends along the inter-articular ligament to the cartilage of the head of the femur.

712. Beneath this synovial membrane, in the back part of the bottom of the cotyloid cavity, is a flattened mass of reddish cellular tissue, mingled with a soft and unctuous substance, forming the largest of the organs that have been described under the name of *Synovial glands.* It receives a prodigious quantity of arterial ramifications which arise from a small branch of the obturator artery which penetrates into the cavity by its inferior notch. Some of these ramifications lose themselves on the membranous sheath of the inter-articular ligament. There issue from it a great number of venous ramifications, which also make their escape through the notch of the cavity, forming a trunk which enters the obturator vein. These vessels are accompanied by a nervous filament of the same name, and are surrounded by a layer of more or less adipose cellular tissue, losing itself on the edge of the mass itself, which is surmounted by very large fringes.

713. The whole circumference of the head of the femur is moreover bordered with numerous small grains of the same nature as those which we have already pointed out in several of the articulations. There is one very large grain of this kind, which raises the synovial membrane close to the insertion of the inter-articular ligament, at the centre of the head of the femur.

714. The ilio-femoral capsular ligament is traversed by a great number of blood-vessels. Many nervous filaments also creep on its surface. The latter arise from the obturator nerve by a branch which separates from it as it passes through the obturator hole, and which divides into five or six twigs at the upper and inner part of the capsule. Another branch, arising from the same trunk, directs itself more downwards following the same direction. It separates upon the capsule into eight or ten filaments, some of which pass

through the notch to be distributed to its inner surface, while the others proceed nearly as far as the small trochanter.

2. FEMORO-TIBIAL ARTICULATION OR KNEE JOINT.

715. This articulation is the most complex in the body. It is an angular ginglymus, into the formation of which there enter the condyles of the femur, the upper extremity of the tibia, and the posterior surface of the patella. The condyles of the femur, together with the pulley which exists between them, are invested by a pretty thick cartilage, which is especially so at the middle part of the condyles. This cartilage does not cover the sides of the condyles, and ascends much higher before than behind. Another less thick cartilage is extended over the posterior surface of the patella. Lastly, a layer of the same substance is observed on each of the cavities formed on the upper extremity of the tibia, and this is also thicker at the centre than at the circumference.

The ligaments of this articulation belong peculiarly to the patella, or are common to the femur and tibia; and they surround a synovial membrane of great extent.

716. *Ligament of the Patella.* This ligament is in reality nothing but the continuation of the tendon of the extensor muscles of the leg, in the substance of which the patella seems to be developed in the same manner as the sesamoid bones (505); nor is it admitted as a distinct ligament by most authors. It forms a flat bundle, about two inches long by one broad, narrower at the middle than at its extremities, more developed above than below, extended from the inferior angle of the patella and the depression at the lower part of its posterior surface to the anterior tuberosity of the tibia (510.) Its *anterior surface* is covered by the skin and a prolongation of the fascia lata. The *posterior surface* is applied at its upper part, upon an adipose mass of remarkable size, which itself rests upon the synovial capsule, and at its lower part is separated from the tibia by a small synovial bursa, which lines a triangular surface of that bone, and which is afterwards reflected over it. This membranous bag is extremely loose, and rather plentifully supplied with synovia. The edges of the ligament of the patella are continuous with aponeuroses which the triceps extensor muscle transmits to the tibia. Its fibres are very different from those of the other ligaments. They are parallel, close, and glistening. The superficial fibres are continuous at the fore part of the patella with those of the tendon of the rectus muscle; the posterior manifestly form a continuation of those of the bone itself.

717. *External Lateral Ligament.* It is situated nearer the posterior part of the articulation than the anterior, and consists of a strong, rounded, fibrous cord, which descends vertically from the tuberosity of the external condyle of the femur to the outer part of the head of the fibula. It is covered in the greater part of its ex-

tent by the tendon of the biceps flexor cruris; internally, it is applied upon the tendon of the poplitæus, the corresponding semilunar fibro-cartilage, to which it intimately adheres, and the synovial membrane. The external inferior articular vessels pass beneath it.

Another ligamentous bundle, (*Ligamentum laterale externum breve*, Weit.) appears accessory to this. It passes behind it, in a parallel direction, from the attachment of the external head of the gastrocnemius muscle, or from the posterior part of the circumference of the corresponding fibro-cartilage to the summit of the upper extremity of the fibula.

718. *Internal Lateral Ligament.* It is also situated a little behind the articulation, and descends from the tuberosity of the internal condyle of the femur to the upper part of the inner edge and surface of the tibia. It is flat, membranous and aponeurotic, thicker anteriorly than posteriorly, much broader below than above. It is covered at its upper part by the aponeurosis of the thigh, and below by an aponeurotic expansion, arising from the tendons of the sartorius, semitendinosus, and gracilis. It is applied over the synovial membrane, the internal fibro-cartilage, which gives insertion posteriorly to a considerable bundle of its fibres, and the tibia.

719. *Posterior Ligament.* Some anatomists consider this ligament as a division of the aponeurosis of the semimembranosus muscle. It appears to me, however, rather to form a distinct ligament, which exists under the form of a fibrous fasciculus, deeply seated at the back part of the articulation, and directed obliquely from the internal tuberosity of the tibia to the outer condyle of the femur. Its fibres are irregular, and present frequent separations for the passage of vessels. It is covered by an aponeurotic plane, which really comes from the semimembranosus, and is applied upon the crucial ligaments, from which it is separated by a great quantity of fat, and by the middle articular vessels.

720. *Anterior Crucial Ligament.* It is inserted into the inner and back part of the outer condyle of the femur, whence it directs itself obliquely towards the uneven depression, which is situated on the fore part of the spine of the tibia. It contracts as it descends; its fibres are slightly twisted upon themselves; and when it has arrived at the tibia, it is continued into the anterior extremity of the internal semilunar fibro-cartilage. Anteriorly, it is invested by the synovial membrane, and posteriorly, is applied by means of cellular tissue upon the following ligament.

721. *Posterior Crucial Ligament.* It arises from the outer and fore part of the inner condyle of the femur, crosses the direction of the anterior crucial ligament, proceeding obliquely outwards and backwards, to the posterior part of the spine of the tibia. It increases much in size as it descends, and its inferior extremity seems divided into two fasciculi, of which one is attached to the tibia, while the other is continued into the posterior extremity of the external semilunar fibro-cartilage. Posteriorly, it is covered by the

posterior ligament, and by a great quantity of cellular tissue. Anteriorly, it is applied against the anterior crucial ligament.

The two crucial ligaments (*Ligamenta cruciata*, Weit.) are not contained within the articulation, as might at first sight be supposed. They are of considerable strength, are composed of dense fibres, and follow such a direction as to cross each other, the one passing before the other, like the two legs of the letter X.

722. *Inter-articular Fibro-cartilages*, or *Semilunar Cartilages*, or *Ligaments*. They occur between the condyles of the femur and the cavities of the superior extremity of the tibia, presenting the form of two flexible, compressible, elastic crescent-shaped laminæ, much thicker at their convex side than at the other, which presents a sharp edge. They only occupy about the two external thirds of the two concave and oval articular surfaces of the tibia, so that the middle of the upper extremity of that bone is free. One of them is *internal*. It is nearly semicircular, a little more elongated from behind forwards however, and broader posteriorly than anteriorly. Its *convex* margin, which is directed inwards, is partly united to the internal lateral ligament. Its *anterior extremity* is attached to the fore part of the spine of the tibia, and is continuous with the anterior crucial ligament. The *posterior extremity* is attached behind the same eminence.

The other fibro-cartilage is *external*. It forms nearly an entire circle. It is broader before than behind. Its *convex margin*, which is directed outwards, is contiguous posteriorly to the tendon of the popliteus muscle, and more anteriorly, affords points of attachment to the posterior fasciculus of the external lateral ligament. Its *anterior extremity* is attached to the rough depression which exists at the fore part of the spine of the tibia; but this insertion takes place much farther back than in the preceding cartilage. Its *posterior extremity* is attached behind the spine of the tibia, before the insertion of the other cartilage, posteriorly to that of the posterior crucial ligament, with one of the two fasciculi of which it is continuous.

These fibro-cartilages are composed of concentric fibres, longer externally than in the interior, less compact towards the extremities than at the middle, and strongly penetrated with cartilaginous matter. They are connected anteriorly to each other by means of a small ligamentous fasciculus, sometimes wanting, about a line broad, and surrounded by soft and yellowish adipose substance. Their *upper surface* is concave, the *lower* nearly plain. Both are very smooth, and lined by the synovial membrane. Their *concave edge* is thin, sharp, and free, and their middle part is hollowed.

723. *Synovial Membrane*. This membrane has a very complicated course, and we shall consider it as arising from the posterior part of the tendon of the extensor muscles of the leg, a place where it forms a very loose and distinct cul-de-sac, particularly apparent when that tendon is reversed from above downwards. It descends from this place over the posterior surface of the patella;

on the sides and lower part of which it is in contact with much adipose cellular tissue. It then separates from the ligament of the patella, rests upon an enormous quantity of fat, and gives rise to a prolongation in the form of a canal, which traverses the articulation, and passes between the two condyles of the femur. Some vessels creep over the surface of this prolongation, and it is commonly filled with a little fat, for which reason some anatomists have given it the name of *Adipose Ligament*; but it cannot by any means be considered as belonging to that class of organs. The synovial membrane, on arriving at the articular surfaces of the tibia, ascends to the lower surface of the semilunar fibro-cartilages, over the concave edge of which it is reflected, for the purpose of lining their upper surface. At its reflection here it contains a great number of blood-vessels in a sort of loose duplicature, much more apparent at the extremities of the fibro-cartilages than at the middle of their concave edge, where, however, it evidently exists. Altogether posteriorly, it surrounds the crucial ligaments and the fat behind them, forming a sort of sheath for them, and thus preventing their being contained within the joint. Lastly, it arrives at the condyles of the femur by several points at once, that is to say, by the *adipose canal*, the sheath of the crucial ligament, and the external circumference of the fibro-cartilages. It covers the whole inferior surface of these condyles, and adheres less to them the nearer it is to their tuberosities, where it invests a bony surface destitute of cartilage. Altogether posteriorly, it is reflected on the fore part of the tendons of the gastrocnemius, and surrounds those of the popliteus.

724. It is at the place where the synovial membrane meets the edge of the cartilages which cover the articular surfaces of the femur and tibia that the small globular masses of reddish cellular tissue occur, which are generally found in the neighbourhood of the joints. They form around the osseous surfaces a sort of cord composed of a great number of small mammillary eminences, which receive numerous ramifications from the articular arteries. There are some also in the cavities situated before and behind the spine of the tibia, as well as on the external circumference of the semilunar fibro-cartilages; but the largest mass is that which is observed beneath the patella and its ligament, and in which Heyligers* says he traced an excretory duct ramified by its roots like that of the pancreas, and opening by several apertures upon the sides of the fibro-cartilages and of the patella.

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* Diss. Physiol. Anat. de Fab. Int. Art. 1803, p. 57.

3. ARTICULATIONS OF THE TIBIA WITH THE FIBULA.

725. Like the two bones of the fore-arm, those of the leg are connected directly by their two extremities, and by their middle part through the intervention of a fibrous membrane. There is this difference, however, between these two parts, that the articulations of the one permit very free motions, while the dispositions of those of the other render motions impossible, or at least very obscure.

UPPER ARTICULATION OF THE TIBIA WITH THE FIBULA.

726. This articulation is an arthrodia, resulting from the contact of two circular flat surfaces, belonging, the one to the tibia, the other to the fibula, and covered with a layer of cartilage. They are lined by a synovial capsule, and are kept in place by two ligaments.

727. *Anterior Ligament.* It descends obliquely outwards from the fore part of the external tuberosity of the tibia before the head of the fibula. It is flattened and rather broad. Its fibres are separated by cellular tissue into several distinct fasciculi. They are parallel, longer above than below. This ligament is strengthened and covered in a great part by the tendon of the biceps flexor cruris.

728. *Posterior Ligament.* This is much less marked, and much weaker than the anterior, and is composed of closer fibres. It presents the same arrangement behind the articulation as the other ligament does at its fore part. It is covered by the popliteus, and sometimes the synovial membrane of the knee joint extends to it.

729. *Synovial Membrane.* It lines the two articular surfaces, the two ligaments, and some irregular fibres which are intermediate between the latter. Anteriorly and above, it is covered by the tendon of the biceps, and posteriorly and above, it is contiguous with the synovial membrane of the knee.

MIDDLE ARTICULATION OF THE TIBIA AND FIBULA.

730. *Interosseous Ligament*, (*Septum longitudinale interosseum*, Weit.) The interval left between the tibia and fibula is filled up by this ligament, which, like that of the fore-arm, (670), presents itself under the form of a thin aponeurotic membrane, broader above than below, composed of oblique fibres which, from the outer edge of the tibia, pass over to a ridge which runs along the inner surface of the fibula, and terminate below at the inner edge of that bone. Its *anterior surface* is covered by the tibialis anticus, extensor longus digitorum, extensor proprius pollicis, and peroneus tertius, and by the anterior tibial vessels. The muscles are partly attached to it by their fleshy fibres. Its

posterior surface covers the tibialis posticus and flexor longus proprius pollicis, which are also in part attached to it. At the upper and outer part, this membrane presents a pretty large aperture for the passage of the anterior tibial vessels. At the lower part, it is continuous with the interosseous ligament of the inferior articulation, and presents a hole, which gives passage to a branch of the peroneal artery. There also occur in various points of its surface, and especially internally, a considerable number of holes for vascular ramifications.

INFERIOR ARTICULATION OF THE TIBIA WITH THE FIBULA.

731. This articulation is manifestly continuous with that of the ankle, from which it borrows part of its synovial membrane, and is formed by means of a convex surface of the fibula, which is fitted to a concave surface of the tibia. Both are invested with a thin cartilage, but at their lower part only. It is in fact only in an extent of two or three lines that they are contiguous, and their cartilage is merely a prolongation of that of the ankle joint. Four ligaments occur here.

732. *Anterior Ligament.* It is triangular, broader below than above, directed obliquely from without inwards, and a little from below upwards, and divided into several fasciculi by cellular tissue. Its *base* is attached to the fore part of the lower extremity of the fibula, and is partly confounded with the ligaments of the next articulation. Its *summit* is inserted into the fore part of the neighbouring portion of the tibia. Its *anterior surface* is covered by the peroneus tertius, the aponeurosis of the leg, and the skin; the *posterior* covers at its upper part the inferior interosseous ligament, and is in contact below with the cartilage of the astragalus.

733. *Posterior Ligament.* This resembles the preceding, but is a little smaller. Its structure is the same. It is attached on the one hand, behind the tarsal extremity of the fibula, and on the other, to the neighbouring part of the tibia. The lateral peroneal muscles cover it, and it lies upon the inferior interosseous ligament and the astragalus. Its fibres, like those of the preceding, are longer the more superficial they are.

734. *Posterior* and *Inferior Ligament.* Continuous with the preceding, and with the posterior ligament of the articulation of the fibula with the tarsus, this ligament is inserted behind the malleolus externus, and directs itself transversely to that of the tibia, passing to the upper part of its articular surface, and forming a very distinct fibrous fasciculus. It forms part of the cavity which receives the articular pulley of the astragalus in the ankle joint.

735. *Inferior Interosseous Ligament.* It fills up the interval left by the osseous surfaces of the articulation above their cartilages. It is a dense tissue, intermingled with some adipose flakes.

Its fibres are very short and adhere strongly to the bones. It seems to be continuous above with the superior interosseous ligament (730), and it can only be well seen on separating the two bones by force, beginning with the upper region.

4. ARTICULATION OF THE TIBIA AND FIBULA WITH THE TARSUS OR ANKLE JOINT.

736. This articulation is a perfect angular ginglymus, for which the fibula and tibia form together a cavity which receives the astragalus, and whose depth is increased by the two malleoli, as well as the different ligaments of the preceding articulation. The tibia and fibula have each their articular cartilage, which is prolonged over their malleolus and the surface by which they touch each other. The articular pulley of the upper surface of the astragalus, and its lateral articular surfaces, are invested by the same cartilage. A synovial membrane is extended over all the parts of this articulation, to which belong two lateral ligaments, two anterior, and a posterior.

737. *Internal Lateral Ligament.* This is a broad quadrilateral band, composed of numerous longitudinal fibres, longer before than behind, and superficially than deeply, which, from the summit of the malleolus internus and its depression, descends obliquely backwards to the inner part of the astragalus and calcaneum, sending also some fibres to the fibrous sheath of the tendon of the flexor longus digitorum pedis. Its *inner surface* is covered by the tendon of the tibialis posticus. The *outer* is invested by the synovial membrane.

738. *External Lateral Ligament*, (*Ligam. fibulæ medium*, Weit.) This ligament is a rounded, narrow fasciculus, very strong, of great length, and having a tendinous appearance, which, arising from the summit of the malleolus externus, descends vertically to be inserted into the upper and middle part of the outer surface of the calcaneum. It is covered by the tendon of the peroneus longus muscle, and covers part of the synovial membrane.

739. *Anterior peroneo-tarsal ligament*, (*Ligamentum fibulæ anterius*, Weit.) Attached to the fore part, and near the summit of the malleolus externus, smaller than the preceding, sometimes divided into two fasciculi, but always regular and quadrilateral, with close and very strong fibres, this ligament passes obliquely forwards to be inserted into the anterior edge of the external articular surface of the astragalus.

740. *Posterior peroneo-tarsal ligament*, (*Ligam. fibulæ posterius*, Weit.) From the depression which exists behind the external malleolus, it passes obliquely downwards and inwards to the posterior part of the astragalus, towards the outer edge of the

groove of the tendon of the flexor longus pollicis pedis. Its fibres are numerous, the anterior shorter than the posterior, and they are divided into distinct fasciculi.

741. *Tibio-tarsal Ligament.* This is an assemblage of some irregular fibres, which do not form a distinct fasciculus, immersed in adipose cellular tissue, and covered by the tendons of the tibialis anticus, extensor proprius pollicis, and extensor communis digitorum. They descend obliquely from within outwards, from the anterior part of the tarsal extremity of the tibia, to the fore part of the articular pulley of the astragalus.

742. *Synovial Membrane.* Of all the membranes of this description, that in question always contains the greatest quantity of synovia. It extends over the cartilaginous surfaces of the fibula and tibia, and ascends between these two bones into the inferior articulation of the tibia and fibula (731.) It is prolonged on the interior of the two malleoli, lines the ligaments which we have described, and ascends upon the lateral articular surfaces, and over the cartilaginous pulley of the astragalus. It is very loose anteriorly and posteriorly, and is there in contact with a great quantity of adipose cellular tissue.

5. ARTICULATION OF THE ASTRAGALUS WITH THE CALCANEUM.

743. The inferior surface of the astragalus is articulated by arthrodia in two places, with the superior surface of the calcaneum. We have already described the surfaces by which this twofold connection is effected, and of which the posterior are much larger than the anterior, which constitute an articulation common to them with that of the scaphoid bone and astragalus. All these surfaces are invested with cartilage. Three ligaments and a synovial membrane are observed here.

744. *Interosseous* or *Superior Ligament.* This ligament, which is narrow and flattened internally, and thick externally, is composed of a great quantity of fibres, of which the external are longer than the internal, and which are concealed in a mass of adipose tissue, although they are very dense and close. It is attached below to the calcaneum, in an uneven and oblique depression, which separates its two articular surfaces, and ascends from thence to a similar groove, which the astragalus presents at its lower surface.

745. *Posterior Ligament.* It is confounded in a great measure with the sheath of the tendon of the flexor longus pollicis pedis, which covers it, and from which it is however distinct. It is formed of a few parallel fibres, which, from the posterior part of the astragalus, direct themselves obliquely inwards to be attached to the neighbouring part of the calcaneum.

746. *External Ligament.* This is a round fasciculus, with dense fibres, which descends parallel to the external lateral liga-

ment of the articulation of the fibula with the tarsus, from the base of the external articular surface of the astragalus, to the outer surface of the calcaneum. It is not described by authors.

The lateral ligaments of the articulation of the tibia with the tarsus also strengthen the union of the astragalus and calcaneum.

747. *Synovial Membrane.* Very loose and separated posteriorly from the tendo Achillis by a great quantity of fat, it invests the posterior cartilaginous surfaces of the two bones, and is moreover prolonged a little backwards over a portion of the calcaneum, which does not belong to the articulation.

In certain cases, the anterior articular surfaces of the calcaneum and astragalus are divided into two orders of surfaces, and then the posterior are furnished with a particular synovial membrane, and the anterior are the only ones that are continuous with the articulation of the scaphoid bone and astragalus.

6. ARTICULATION OF THE CALCANEUM WITH THE SCAPHOID BONE.

748. In this articulation, there is no connection of surfaces between the two bones, and they are merely kept together by two very strong ligaments.

749. *Inferior Ligament between the Calcaneum and Scaphoid Bone.* It presents itself under the form of a flat, very thick, almost fibro-cartilaginous fasciculus, formed of dense, compact, whitish fibres, directed obliquely inwards and forwards, from the anterior part of the small tuberosity of the calcaneum, to the inferior surface of the scaphoid bone. It is frequently divided into two fasciculi, the one external and thin, (*Ligamentum planum*, Weit.), the other internal and very strong (*Ligamentum teres*, Weit.) Inferiorly, it is situated over the tendon of the tibialis posticus, and above, forms a cavity with the calcaneum and scaphoid bone for receiving the head of the astragalus.

750. *External Ligament between the Calcaneum and os Scaphoides.* Like the preceding, it enters into the composition of the cavity which receives the astragalus, at the inside of which it is chiefly visible. It is a very short fasciculus, which, from the lower and outer part of the scaphoid bone, proceeds to the fore and inner part of the calcaneum. Its fibres are very numerous.

7. ARTICULATION OF THE SCAPHOID BONE WITH THE ASTRAGALUS.

751. This articulation is an enarthrosis, which is formed by the head of the astragalus entering into a cavity which the posterior surface of the scaphoid bone, a portion of the calcaneum, and the two preceding ligaments, concur to form. The bony surfaces are covered with a cartilage which is prolonged upon the astragalus much farther below than above. A single ligament and a synovial

capsule belong to this articulation, in which there are observed, moreover, two of those cellular masses which have been taken for synovial glands. These are very distinct.

752. *Ligament between the Scaphoid Bone and Astragalus.* It arises from the upper part of the neck of the astragalus, and passes to the upper part of the scaphoid bone. It is a broad, thin, horizontal fasciculus, with parallel fibres, which are directed a little obliquely from within outwards, and of which the inner are longer than the outer. It is covered by the tendons of the extensor digitorum, and sends some fibres to the cuneiform bones.

753. *Synovial Membrane.* Forming a cul-de-sac between the astragalus and calcaneum, it invests the head of the former of these bones, then the ligament of the scaphoid bone and astragalus at its lower surface, the posterior surface of the scaphoid bone, and the two ligaments of the articulation of the calcaneum with the scaphoides. It is strengthened externally at the inner part by bundles of irregular fibres.

8. ARTICULATION OF THE CALCANEUM WITH THE CUBOID BONE.

754. This articulation is formed by an arthrodia which results from the contact of the anterior surface of the calcaneum and the posterior surface of the os cuboides, which are kept in connection by two ligaments, and lined by a synovial membrane.

755. *Superior Ligament between the Calcaneum and os Cuboides.* This ligament is broad, thin, divided into fasciculi by the intervention of much adipose substance, and formed of several superimposed planes. Its fibres, which are rather short, originate from the upper and fore part of the calcaneum, and are inserted into the corresponding part of the os cuboides. They lie upon the synovial membrane, and are covered by the tendon of the peroneus tertius.

756. *Inferior and Superficial Ligament between the Calcaneum and os Cuboides.* (*Ligamentum Longum Plantæ*, Weit.). This is the longest and strongest of the ligaments of the foot. Its thickness, its pearly lustre, and the longitudinal direction of its fibres are very remarkable. It arises from the posterior and inferior part of the calcaneum, and passing directly forwards, terminates in part at the oblique tuberosity which is observed at the inferior surface of the os cuboides. The rest of its fibres, which are much longer than the others, pass above the fibrous sheath of the peroneus longus, and divide into several fasciculi which go to the posterior extremity of the third and fourth metatarsal bones, and give insertion to muscular fibres. They correspond below to the deep-seated muscles of the sole of the foot.

757. *Inferior and Deep Ligament between the Calcaneum and os Cuboides.* This ligament, which is shorter and situated higher than the preceding, and separated from it by a great quantity of adipose cellular tissue, arises from the calcaneum before the superficial li-

gament, and proceeding a little inwards, is inserted wholly into the tuberosity of the os cuboides.

758. *Synovial Membrane.* Its course is sufficiently simple, as it only covers the two cartilaginous surfaces, and the upper and inferior deep ligaments between the calcaneum and cuboid bone. It is seen exposed in several of the interstices in the former. Externally, it corresponds to the sheath of the peroneus longus, and internally to a fibrous and cellular tissue.

9. ARTICULATION OF THE SCAPHOID WITH THE CUBOID BONE.

759. A kind of *interosseous ligament* is observed between the scaphoid and cuboid bones. It is very strong and firm, with short and dense fibres, and is firmly attached to the two bones. In the sole of the foot, there is also observed another *inferior ligament*, which is rounded, concealed in the cellular tissue, and extended obliquely between the scaphoid and cuboid bones.

When the two bones touch each other by a surface covered with cartilage, there is observed, moreover, a small special *synovial bag*, and a *dorsal ligament*, which passes transversely under the form of a quadrilateral fasciculus, and is covered by the tendons of the extensor communis digitorum.

10. ARTICULATION OF THE THIRD CUNEIFORM BONE WITH THE CUBOID.

760. The outer side of the third cuneiform bone is articulated to the os cuboides by a cartilaginous surface, covered by a *synovial capsule.* A *dorsal ligament* and a *plantar ligament* are the only bonds of this articulation. The first, which is thin and oblique, is inserted into the upper part of the neighbouring edge of the two bones. Its fibres are separated by vascular intervals; the other, which is much thicker, is seen at the lower surface of the tarsus. It is attached to the inner part of the os cuboides, and passes over to the plantar surface of the third cuneiform bone. Its fibres are transverse. There also occurs between these two bones, in the points where they are not in immediate contact, a fibrous and cellular tissue, analogous to most of the interosseous ligaments.

11. ARTICULATIONS OF THE CUNEIFORM BONES WITH THE SCAPHOID.

761. The scaphoid bone is articulated by means of its anterior surface with the three cuneiform bones, forming an arthrodia. The surfaces by which these bones are in contact are covered with cartilages, which are continuous with those of the articulations of

the cuneiform bones with each other. A synovial membrane and six ligaments are observed here.

762. *Dorsal Ligaments.* Of these there are three, an internal, a middle, and an external. Their insertions into the scaphoid bone are confounded with each other. They take place at the upper part of that bone, whence they proceed in a diverging manner to the corresponding extremity of each of the cuneiform bones. The first, which is divided into two fasciculi, is thicker below than above, and is strengthened by the tendon of the tibialis anticus. The others are not so broad or strong.

763. *Plantar Ligaments.* These are also three in number, and are less distinct than the preceding. Their fibres, which are parallel and close, are united into a single fasciculus beneath the scaphoid bone, but separate on arriving at each of the cuneiform bones. Some of the fibres of these ligaments come from the termination of the tendon of the tibialis posticus.

764. *Synovial Membrane.* It is common to the articulations of the cuneiform bones with each other, and with the scaphoid bone. It lines the ligaments by which they are connected together with their investing cartilages.

12. ARTICULATIONS OF THE CUNEIFORM BONES WITH EACH OTHER.

765. The cuneiform bones are mutually articulated by surfaces covered with cartilage. Two ligaments directed transversely, which seem united into one, fasten them at their upper part, passing from the dorsal surface of the second to those of the third and first. Two other ligaments, transverse also, but less distinct, and covered by a prolongation of the tendon of the tibialis posticus, proceed from the plantar surface of the second to those of the first and third also. That which is on the inside is much stronger than that which is on the outer. Between the articular surfaces, there are observed some interosseous fibres. The synovial membrane is the same as that of the preceding articulation.

13. ARTICULATIONS BETWEEN THE TARSUS AND METATARSUS.

766. We have already pointed out the disposition of the surfaces which contribute to the formation of these articulations (533—539), which are so many very close plain arthrodiæ. They are invested by a thin cartilage, and kept in connection by dorsal and plantar ligaments. There are also observed synovial capsules in them.

767. *Dorsal Ligaments.* Each of the metatarsal bones receives one from each of the tarsal bones with which it is connected. Thus the first presents a broad and thin ligament which comes from the first cuneiform bone; the second presents three, which come from

the three cuneiform bones, and which unite by converging at the upper part of its posterior extremity; the third has one which comes from the third cuneiform bone, and sometimes a second from the os cuboides; lastly, the latter bone gives one to the fourth and fifth metatarsal bones. All these ligaments are covered by the tendons of the extensor muscles of the toes, and applied over the synovial capsules.

768. *Plantar Ligaments.* These are equal in number to the dorsal ligaments and disposed nearly in the same manner. That of the first metatarsal bone is very strong. It is attached to the tuberosity which is observed at the lower part of its posterior extremity, and comes from the anterior part of the base of the first cuneiform bone. The *internal plantar ligament* of the second metatarsal bone is also remarkable for its thickness and length. It sends some fibres to the third metatarsal bone. The two others are covered by a prolongation of the tendon of the tibialis posticus. The other ligaments present nothing particular. The sheaths of the tendons which are observed in the sole of the foot, and especially that of the peroneus longus, contribute much to strengthen all these ligaments.

769. *Synovial Membranes.* The first metatarsal bone and the first cuneiform have one entirely separate, and strengthened internally by a prolongation of the tendon of the tibialis anticus. Another is common to the articulations of the second metatarsal bone with the three cuneiform bones, and of the first two of these bones with each other. There is one for the union of the third metatarsal bone with the third cuneiform, which sends prolongations between the surfaces of the two neighbouring metatarsal articulations. Lastly, a single synovial membrane serves for the articulation of the two last metatarsal bones with each other and with the os cuboides.

14. ARTICULATIONS OF THE METATARSAL BONES WITH EACH OTHER.

770. These articulations have a great resemblance to those of the metacarpus. As in the hand, the first metatarsal bone is not immediately articulated with the next posteriorly; but anteriorly, the transverse ligament of the toes extends to it. The other four are directly articulated at their posterior extremities, by means of surfaces covered with cartilage and lined by prolongations of the synovial membranes of the preceding articulations. There are here *dorsal* and *plantar ligaments*, similar to each other, and to those of the metacarpus (698). They extend transversely in each region from the second to the third, from the third to the fourth, and from the fourth to the fifth metatarsal bones. There are, besides, interosseous fibres between the points of the surfaces which are not articular.

771. *Transverse Metatarsal Ligament.* It connects together the anterior extremities of the five metatarsal bones; which have no direct connection by bony surfaces; and is in all respects similar to that which we have described for the heads of the last four metacarpal bones (699.)

15. ARTICULATIONS OF THE METATARSAL BONES WITH THE PHALANGES.

772. These articulations constitute arthrodiæ, and are formed by means of surfaces covered with cartilage (529—535), and strengthened by two lateral ligaments and an inferior ligament, perfectly similar to the lateral and anterior ligaments of the articulations between the metacarpus and phalanges of the fingers (697, 698). The synovial membrane is only here a little looser and more extended than in the hands.

16. ARTICULATIONS OF THE PHALANGES OF THE TOES.

773. Their surfaces, ligaments and synovial membranes are in all respects similar to those of the fingers, only the ligaments are a little smaller on account of the inferior size of the bones themselves.

C. ARTICULATIONS OF THE HYOID BONES.

774. The hyoid bone is not directly connected with any of the surrounding bony organs; but it has distant connections with the temporal bone by means of the stylo-hyoid ligament. The different pieces of which it is composed touch each other by cartilaginous surfaces, and are kept in position by ligaments. The latter articulations become obliterated with age.

775. *Stylo-hyoid Ligament*, or *Suspensory Ligament of the Hyoid Bones.* This is a slender and very elongated fasciculus, broader below than above, formed of parallel, whitish and glistening fibres, which descend obliquely forwards and inwards from the styloid process of the temporal bone (177) to the small horns of the os hyoides (323), where it is attached so as to form an extremely acute angle with the great horns. It is frequently full of bony granulations, varying in size and number. Sometimes it scarcely exists, which happens when the styloid process descends to the hyoid bone, as is observed to be the case in some subjects. It varies exceedingly in other respects also, and has even been seen substituted by a muscle.*

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* Weitbrecht. Syndesm. 4to. Petropoli, 1742, p. 213.

MYOLOGY,

OR

A DESCRIPTION OF THE ACTIVE ORGANS OF LOCOMOTION.

CHAPTER FIRST.

OF THE ACTIVE ORGANS OF LOCOMOTION, OR OF THE MUSCLES AND THEIR APPENDAGES IN GENERAL.

I. *Of the Muscles.*

776. The *Muscles (Musculi)*[*] are organs formed of long parallel fibres commonly of a red or reddish colour, soft, irritable, contractile, united into distinct fasciculi, varying in number and size, and themselves composed of subordinate fasciculi.

777. In the body of man, and of the vertebrate animals in general, we find two classes of muscles. Some, which are internal, membraniform and hollow, are especially destined for the functions of nutrition and generation; others, which are external, are more or less thick and solid, and are subservient to what most physiologists call the *animal functions*.

778. The character by which the muscles of the latter order are essentially distinguished, is the faculty which they possess of contracting under the influence of the will, and of thus becoming the efficient cause of most of the motions performed in the animal body (15). They owe this property to the *organic element* which we have termed *Fibrin* (8), which constitutes the greater part of their mass, and seems to be prepared beforehand in the blood, where its presence is easily detected, and where it even appears to crystallize under the eye at the moment of coagulation, according to the expression of an eminent modern anatomist; a circumstance that has given rise to the saying, which has much appearance of reason, that *blood is liquid flesh*.

779. The *fibrous tissue* which forms the proper part of the or-

[*] Μῦς from Μυεῖν.

ganization of a muscle, is deposited in the parenchyma of that organ, much in the same manner as the phosphate of lime is in that of bone. Every muscle therefore seems to be a sort of reservoir of fibrin.

780. The *muscular* or *fleshy fibre* is flat, soft, downy, linear, possessed of little elasticity, more or less red, bent in a zigzag manner in its longitudinal direction, varying extremely as to length, firmer in adults than in children and old people, of the same size in small as in large muscles, and passing through its course without bifurcating or ramifying. It possesses little tenacity in the dead body, and is easily torn asunder; but, during life, it sustains very great efforts without breaking. It is itself composed of a great number of fibrils similar to each other, subdividing to infinity without the possibility of discovering their first elements, forming *secondary, ternary fasciculi*, &c., by these successive divisions acquiring such a degree of tenuity as to elude even the microscope, collected into larger fasciculi, and almost entirely formed of fibrin. The last of these filaments that can be perceived, do not appear to be hollow, as some anatomists have alleged. They have in general a prismatic or flattened, pentagonal or hexagonal form, but are never cylindrical. Their diameter varies little, and their length equals the entire interval between their two insertions. On examining them with the microscope, as was formerly done by Hooke, Leeuwenhoeck and Muys, and recently by Prochaska, the brothers Wenzell, Autenrieth, Sprengel, Sir Everard Home, Bauer, Prevost, Dumas, and Beclard, it is found, and I have satisfied myself of the fact by my own observations, that the finest muscular fibres are identical with the particles of the blood deprived of their colouring matter, and whose central globules are united into filaments, by a sort of jelly or mucus, the essential nature of which is not yet understood. Their colour is accidental, and does not exist in all red-blooded animals, some of which have the muscles white; but in the greater number their tint is very decided, and becomes deeper and deeper with age.

781. A variable number of muscular fibres, therefore, united into approximated fasciculi, and forming a distinct mass, varying much as to size and form, having its extremities attached to the bones by means of tendons or aponeuroses, constitutes a muscle, in which there is also distinguished a downy cellular tissue as the basis, together with ramifications of nerves, arteries, veins, and lymphatics. It is in fact from the union of all these different organic systems, that the muscular system really results, which of itself forms the greater part of the volume and a great part of the weight of the body.

782. The *Cellular Tissue* is an important element of the muscular system. It connects the fleshy fibres. It is not very visible between the smaller fibres, but becomes more so in proportion as they unite into larger fasciculi, and forms for each of the latter a sheath in which they are inclosed. After uniting several of these

fasciculi to form an entire muscle of them, the cellular tissue constitutes a very distinct layer around it, and this layer in most cases is of a membranous appearance, rather loose, and filled with fat in greater or less quantity according to the subject. It is of it that the general sheath of the united fasciculi is constituted; and the cellular tissue of the muscles may be considered as a collection of envelopes contained within each other, and diminishing in thickness and denseness from without inwards, so that those which surround the fasciculi of a lower order are in a manner invisible, so great do their tenuity and softness become.

783. Now, this cellular tissue of which we have already had repeated occasion to speak, is itself an assemblage of lamellæ, of very minute, soft whitish filaments, crossing each other in a multitude of different directions, leaving in their intervals areolæ, consisting of numerous irregular cellules, which communicate with each other. This tissue surrounds and penetrates all the organs of the system. It is the seat of a serous exhalation, the product of which is accumulated in greater or less quantity in its cellules. It must not be confounded with another tissue which is also very extensively distributed, and which is immersed in its proper substance. I mean the *Adipose Tissue.* This, which is in particular very abundant in the general cellular envelope of the muscles, is composed of small masses, pretty regularly rounded, agglomerated and connected with each other. Each of these granulations is a small membranous, isolated vesicle, filled with fat, and of which the interior is divided by several incomplete partitions, while its surface is covered by blood-vessels.*

784. From the neighbouring trunks the muscles receive very distinct arteries, whose size and number are always proportional to the volume of the muscle. They penetrate its substance from all points of its surface, although their entrances are generally more towards the middle than at the extremities. Their principal branches creep at first between the largest fleshy fibres; then they divide and subdivide into an almost infinite number of ramifications which ultimately become capillary, to be introduced, always running along the cellular envelopes, and incessantly presenting new divisions and new anastomoses, between the subordinate fasciculi and between the fibres themselves. With the exception of certain viscera, such as the lungs and kidneys, there are few organs which receive so much blood as the muscles.

785. The veins follow, in the muscles, the same progress as the arteries, which they accompany along their whole course; but they surpass them, as they do every where else, in number and magnitude. Some of their principal branches even creep at the surface of the muscles, without corresponding to any artery. Bichat is of opinion that in general they are but scantily supplied with valves.

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* Beclard, Propositions sur quelques points de Medecine, 4to. Paris, 1813.

Like the arteries also, they communicate with the vessels of the neighbouring tegumentary membranes of the muscles.

786. The lymphatic vessels are not easily traced in the muscles; but in the tongue, the diaphragm, and especially the face, some trunks are perceived which penetrate the fleshy fibres.

787. The nerves of the muscles of voluntary motion are numerous and of variable size. Excepting the skin and the organs of sense, no part is so abundantly supplied with them. They come almost all from the brain; a few, however, proceed from ganglions, and accompany the arteries. The small muscles have never more than a single nervous branch; those of large size are penetrated by several branches at once; but, in general, few organs receive so many. In the extremities, the nerves enter the muscles, by following nearly the same direction, and at a point more or less near their upper extremity, and seldom beneath their middle part. In the trunk, on the contrary, they often introduce themselves into the muscle, by forming a more or less acute, or a right angle with them. In general, they penetrate the fleshy tissue at the same time as the vessels, and especially the arteries, with which they are closely connected by cellular tissue.

After entering the muscles, the nerves divide and subdivide, until they at length entirely disappear. It has not yet been ascertained if each muscular fibril receives a nervous filament; but it appears that before terminating they become gradually softer, so that the medullary substance of these nerves would be in immediate contact with the muscular fibre.

788. When exposed to the air, after being cut into small pieces, the muscular tissue dries up; but if it be submitted in mass to the influence of that agent, it putrefies. In the former case, it acquires a brown colour, and becomes hard, and to a certain degree transparent; in the latter, it becomes green, livid, very fœtid, and often phosphorescent. In cold water it loses its red colour, and imparts it to the liquid in which it is immersed; it assumes a straw-colour, softens at the end of a considerable period, and is converted into putrilage or adipocire. By repeated washings with softening, the muscular parenchyma is reduced to the state of nearly pure fibrin (8.) In boiling water, on the contrary, it crisps and acquires a greater density. At the end of some time, however, it softens, and has lost all power of curling under the influence of caloric or concentrated acid, as it did before boiling; the downy part seems to dissolve, and there only remain fibres divisible to infinity, and by their tenuity escaping all calculation. The muscle has then lost the albumen, gelatin, fat and salts which formed part of its substance; but it still retains its form. It also in general putrefies less readily under these circumstances.

789. By the action of fire, the muscles are more deeply coloured, become denser at their outside, lose a part of their substance, which liquefies, and change their consistence and taste. Under the action of nitric acid, they are transformed into a yellow substance,

and emit much azote. Alcohol, diluted acids, and solutions of alum, common salt, and nitrate of potash, increase their consistence.

790. The organic elements of the muscles are fat, gelatin, albumen, a great quantity of fibrin, a principle of a peculiar nature, coloured, soluble in alcohol, giving to broth its taste and smell, and named *Osmazome** by M. Thenard, who discovered it. There also occur in these organs a colouring matter somewhat different from that of the blood, carbonate, hydrochlorate and phosphate of soda, phosphate of lime, and oxide of iron. If the analysis is pushed farther, the results obtained are a great quantity of azote, hydrogen, oxygen, carbon, iron, phosphorus, soda, and lime.

791. The muscles, like the bones, may be divided into *long*, *broad*, and *short*, and each of these kinds may present muscles which may be either *simple* or *compound.*

792. The *simple muscles* have all their fibres in a similar direction. They are in general *bulging*, that is to say, they present the form of an elongated fasciculus, whose transverse outline is rounded, and which is more or less inflated in the middle. This form depends upon the mode of insertion of the fleshy fibres, which, arising above and terminating below, one after another in succession, are so much less numerous the nearer to each extremity that they are examined. The rectus femoris and supinator longus furnish examples of this arrangement. The simple muscles are sometimes *flat*, and have parallel fibres, which form a kind of fleshy band, as we observe in the sartorius, &c. or broad and very extended membranes, as in most of the abdominal muscles. These two kinds of muscles have sometimes tendons or aponeuroses in their middle, or in some part of their extent. Of this description are the masseter, the recti abdominis, &c.

793. There are also *simple radiated muscles*, and *simple penniform muscles* of the same order. The fibres of the former proceed from a common centre, and are disposed like the radii of a circle, as is the case with the diaphragm, the iliacus internus, the temporal muscle, &c.; those of the latter are disposed in two rows, forming an angle with each other, like the barbs of a feather. A variety of this muscle is that which is named *semi-penniform*, and which has its fibres also oblique, but on one side only. The flexor carpi radialis is penniform, the flexor carpi ulnaris, semi-penniform.

794. The *compound muscles* are those which have but a single belly and several tendons, like the flexors of the fingers; or several bellies and several tendons, like the biceps flexor cubiti, the sacro-lumbalis, &c.

795. We have already made known the various situations which the bones may have with relation to the different planes of the body, (45.) It is the same with respect to the muscles. Their size and direction may also sometimes serve to distinguish them from

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* *'Οσμη, odor ; ζωμος, jus esculentum.*

each other; but it is in their form that they exhibit the greatest number of varieties. There are, in fact, triangular muscles, as is the case with several of those that are observed in the hand; cubical, as the masseter and pterygoid muscles; square and flat, as the pronator quadratus of the fore-arm; rhomboidal, orbicular, serrated, and trapezoidal. In most cases, the muscles are in pairs, there being very few single, &c.

796. In general, the name of *Belly* is given to the middle portion of a muscle, while its extremities are named the *Head* and *Tail*, or more commonly the *Origin* and *Insertion*. Whence the names of *gastrocnemius*, *digastric*, *biceps*, *triceps*, &c. according as they present two bellies, two or three heads, &c.

2. OF THE TENDONS.

797. The *Tendons* (*Tendines*) are very elastic, tenacious fibrous cords, of an intermediate nature between bones and muscles, transmitting to the former the motions of the latter, and absolutely passive in themselves. It would seem that these organs are for the most part true prolongations of the periosteum, for all their fibres appear to arise from that membrane, or at least to be confounded with it. They differ from the ligaments only in the circumstance that one of their extremities is manifestly continuous with the fleshy body of a muscle.

They are sometimes concealed in the midst of the muscular fibres; but they always terminate them, for a muscle is never fixed to a bone without their assistance or without that of aponeuroses, and they may even to a certain extent be considered as flexible appendages to the bones, nearly as solid as themselves, and presenting to the fleshy body a multitude of points of attachment.

In most cases the tendons have a rounded cylindrical form. There are also some which are flat, radiated, bifurcated, digitated, perforated or perforating, &c. Some proceed in a straight line; others are reflected and deviate more or less from their original direction. They are all covered with a loose cellular tissue, which allows them to slide easily over the neighbouring parts, or over each other. This sliding is even not unfrequently favoured by a particular synovial membrane, or by a cartilage developed on the surface of the bone.

Their organization is always the same. They are composed of very close, fine, white, glistening longitudinal fibres, not interlaced, but placed parallel to each other, incapable of being elongated, but susceptible of being extended into membranes. The resistance of these fibres is considerable; they support enormous weights without breaking, and their strength is much superior to that of metallic wires, so long as they are kept moist.

The tendons have very few blood-vessels; in fact none are observed in them in their ordinary state. Nor have any nerves been traced in them. Their affinity for phosphate of lime is remarkable, and sesamoid bones are very frequently developed in their substance.

They present much the same chemical characters as the ligaments; but by maceration they soften readily without dilating or swelling; their fibres separate from each other, and at length change into a soft whitish pulp, which appears to be homogeneous. In boiling water they curl at first, then soften, become semitransparent, and dissolve almost entirely into jelly. Exposed to the air, they dry up and become similar to horn.

3. OF THE APONEUROSES.

798. The *Aponeuroses* are fibrous expansions, which are prolongations of the ligaments, tendons, or periosteum, but which on being strictly examined appear always to originate from the latter membrane, or to terminate in it. They are more or less broad, and so disposed as to envelope the muscles in a sort of sheath, or to furnish points of attachment to their fleshy fibres; for it is remarkable that the latter are never fixed directly to a bone or even to the periosteum, but are connected with them by the intervention of fibrous organs, such as tendons or aponeuroses, as we have already said, (797.)

The aponeuroses of the first kind may surround a whole limb, and envelope its muscles entirely, as is the case in the thigh; or they may serve as a bridle to keep the muscles in their place, without covering them in all parts, as is observable in that which unites the two small posterior serrati.

Those of the second kind are sometimes broad, as is seen on the cruralis, gastrocnemius, &c. In other cases, they form arches for allowing vessels and nerves to pass, at the same time that they give attachment to the fleshy fibres, as in the diaphragm. Lastly, they are composed of isolated fibres in the substance of the muscle, as in the masseter and pterygoid muscles.

The *Enveloping Aponeuroses* vary much in their thickness, which is, however, in general, so much greater, the larger and more numerous the muscles are which they surround. Their two surfaces are always in contact with cellular tissue; but the inner surface frequently sends between the muscles fibrous prolongations which extend to the periosteum of the neighbouring bones. They are of a shining white colour, and might be considered as tendons expanded into membranes, did they not offer a little more resistance to maceration and boiling. Their fibres are also more or less interlaced.

The *Aponeuroses of Insertion* sometimes result from the expansion of a tendon, as in the rectus femoris, or arise immediately from the periosteum, as in the masseter. They may also furnish points of attachment by their two surfaces, or by one of them only, and they afford the very great advantage of multiplying them much without any loss of surface. Those which are arched serve to prevent the vessels from suffering compression during the contraction of the muscle.

4. OF THE FIBROUS SHEATHS.

799. The *Fibrous Sheaths* are a kind of envelopes destined to keep down the tendons at their passage over the bones, in the places where they are reflected, and to prevent them from experiencing any other deviation than that caused by the contraction of the muscles to which they belong. Some of these sheaths, as those of the wrists, contain the united tendons of several muscles; others, as those of the fingers, are intended for a single tendon, or for two only.

Of these latter, some are of considerable length, while others merely form a kind of ring. They all, in general, present the form of a hollow semi-cylinder, which is completed by the bone to which they are attached; and they thus form a sort of canal. This canal is lined by a synovial membrane. They are confounded at their edges with the periosteum. They are very strong, and their tissue is very dense and close.

The fibrous sheaths which envelope several tendons together, bear the name of *Annular Ligaments*. Some of them, as at the fore part of the wrist, leave all the tendons in contact with each other; those of the posterior part of the wrist, on the contrary, send between them small fibrous partitions which serve to isolate them.

5. NOMENCLATURE OF THE MUSCLES.

800. There is much difference as to the number of the muscles. Some authors make them amount to four hundred and more; M. Chaussier admits only three hundred and sixty-eight. As most of the muscles are in pairs, and there are but very few single, it might be supposed that the number of names would be much less. Yet the greatest confusion prevails in their nomenclature; for there is not one among them that has not received more than one name, and some have as many as a dozen, which sufficiently accounts for Dr. Schreger, of Furth, having employed a thick octavo volume to unravel these complicated synonymes.

Some, in fact, have been named after their *uses;* for example, the diaphragm, buccinator, extensors, supinators, pronators, flexors, levators, depressors, constrictors, &c. But it sometimes happens that an error has been committed in this respect, and besides a muscle may have several uses at once. Thus the levator anguli scapulæ, in raising the posterior angle of the bone, depresses the anterior angle.

Other muscles have derived their name from their *position;* of which kind are the interspinales, interossei, palpebralis, labial, pectoral, subclavian, popliteal, ulnar, iliac, temporal, &c. But frequently there are several different muscles in each region.

There are others whose names are indicative of their *form*, such as the trapezius, quadratus lumborum, serratus, digastricus, deltoid, scalenus, rhomboideus, pyramidalis, triangularis sterni, &c. Some again are named on account of their *resemblance to some object:* the splenius, which is supposed to resemble the spleen; the lumbricales, which look like earthworms; the soleus, in which there is recognised the appearance of a sole or flounder. Others bear a name which has reference to their *dimensions*, their *extent*, or *volume:* the flexor longus digitorum, gracilis, vastus externus, supinator brevis, pectoralis major, &c.; or to their direction: obliqui abdominis, recti capitis, orbicularis oris, &c.; or to their *composition:* semitendinosus, semimembranosus, triceps, biceps, complexus, &c.; and even to their *numerical order* as the interossei which may be designated *first*, *second*, *third*, &c.; or to their *relative situation*, which has caused them to be called anterior, superior, superficial, deep seated, &c.

Many muscles have been designated according to the various points of the skeleton to which they are attached, as the sterno-cleido-mastoideus, occipito-frontalis, stylo-hyoideus, hyo-glossus, &c. It is on this circumstance that M. Chaussier's nomenclature is founded. M. Dumas, on the other hand, has attempted to render the names of the muscles descriptive of their nature and relations, which renders them complicated in an extraordinary degree, without affording any great advantage. M. Dumeril, again, wishing to apply to anatomy the method followed in natural history and chemistry, has proposed an anatomical nomenclature, in which he has prodigiously reduced the number of words in the science, as he only admits the names of the bones and viscera, of which he has merely changed the termination to make known the other organs. Thus he proposes using the word *sternal* for the sternum, and employs in succession the terms *sternienne*, *sternien*, *sternique*, *sternaire*, *sternale*, to designate the region, the muscle, the nerve, the artery, and the vein, which are connected with it. It will easily be conceived how such a nomenclature, were it adopted, would relieve the memory, and facilitate the study of anatomy, by enabling us to avoid all the whimsical denominations, and the odd mixture of Greek, Latin, Arabic, and other words, which form the ordinary language of anatomy. [As no scientific nomenclature however, has been generally adopted in this country, we prefer employing the names in common use.—K.]

6. CLASSIFICATION OF THE MUSCLES.

801. Anatomists have successively introduced various modes of dividing the muscles. Some, and in particular Winslow, have arranged them according to their uses. Albinus, Sabatier, Boyer, and Bichat have employed a method which appears to us more congenial to a descriptive science; they have distributed them according to the different parts of the body which they occupy; and each of these parts has received the name of a *Region*. It is this classification which we adopt as the more elementary,* and which we now proceed to unfold in a general manner.

MUSCLES OF THE TRUNK.

I. *MUSCLES OF THE VERTEBRAL COLUMN.*

1. *Anterior Vertebral Region.*
    - Longus colli.
    - Psoas magnus.
    - Psoas parvus.
2. *Posterior Vertebral Region.*
    - Interspinalis cervicis.
    - Interspinalis dorsi.
    - Interspinalis lumborum.
    - Spinalis dorsi.
    - Semispinalis dorsi et colli.
    - Sacro-spinales { Longissimus dorsi. / Sacro-lumbalis.
    - Transversalis colli.
3. *Lateral Vertebral Region.*
    - Intertransversales colli.
    - Intertransversales lumborum.

II. *MUSCLES OF THE CHEST.*

1. *Anterior Thoracic Region.*
    - Pectoralis major.
    - Pectoralis minor.
    - Subclavius.
2. *Lateral Thoracic Region.*
    - Serratus magnus, united with the Levator anguli scapulæ.
3. *Intercostal Region.*
    - Intercostales externi.
    - Intercostales interni.

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* At the end of the description of the muscles will be found a table pointing out the order which must be followed to dissect them all on the same subject, also references to the page where each of them is treated of.

Levatores costarum.
Triangularis sterni.

4. *Region of the Diaphragm.*
    - Diaphragma.
5. *Vertebro-costal Region.*
    - Serratus posticus superior.
    - Serratus posticus inferior,
6. *Posterior Thoracic Region.*
    - Latissimus dorsi.

III. *MUSCLES OF THE HEAD.*

A. MUSCLES OF THE SKULL.

1. *Epicranial Region.*
    - Frontalis.
    - Occipitalis.
2. *Auricular Region.*
    - Attollens auriculam.
    - Prior auriculæ.
    - Retrahens auriculam.
3. *Anterior Occipito-cervical Region.*
    - Rectus capitis anticus major.
    - Rectus capitis anticus minor.
4. *Posterior Occipito-cervical Region.*
    - Rectus capitis posticus major.
    - Rectus capitis posticus minor.
    - Obliquus capitis inferior.
    - Obliquus capitis superior.
5. *Lateral Occipito-cervical Region.*
    - Rectus capitis lateralis.

B. MUSCLES OF THE FACE.

1. *Palpebral Region.*
    - Orbicularis palpebrarum.
    - Corrugator supercilii.
    - Levator palpebræ superioris.
2. *Ocular Region.*
    - Attollens oculum.
    - Depressor oculi.
    - Adductor oculi.
    - Abductor oculi.
    - Obliquus superior oculi.
    - Obliquus inferior oculi.
3. *Nasal Region.*
    - Pyramidalis nasi.
    - Triangularis nasi.
    - Levator labii superioris alæque nasi.
    - Depressor alæ nasi.

4. *Superior Maxillary Region.*
    - Levator labii superioris.
    - Levator anguli oris.
    - Zygomaticus major.
    - Zygomaticus minor.
5. *Inferior Maxillary Region.*
    - Depressor anguli oris.
    - Depressor labii inferioris.
    - Levator menti.
6. *Intermaxillary Region.*
    - Buccinator.
    - Orbicularis oris.
7. *Pterygo-maxillary Region.*
    - Pterygoideus internus.
    - Pterygoideus externus.
8. *Temporo-maxillary Region.*
    - Masseter.
    - Temporalis.
9. *Lingual Region.*
    - Hyoglossus.
    - Genio-glossus.
    - Stylo-glossus.
    - Lingualis.
10. *Palatal Region.*
    - Circumflexus palati.
    - Levator palati mollis.
    - Levator uvulæ.
    - Palato-pharyngæus.
    - Constrictor isthmi faucium.

IV. *MUSCLES OF THE NECK.*

1. *Anterior Cervical Region.*
    - Latissimus colli.
    - Sterno-cleido-mastoideus.
2. *Superior Hyoid Region.*
    - Digastricus.
    - Stylo-hyoideus.
    - Mylo-hyoideus.
    - Genio-hyoideus.
3. *Inferior Hyoid Region.*
    - Omo-hyoideus.
    - Sterno-hyoideus.
    - Sterno-thyroideus.
    - Thyro-hyoideus.
4. *Pharyngeal Region.*
    - Constrictor pharyngis inferior.
    - Constrictor pharyngis medius.

  - Constrictor pharyngis superior.
  - Stylo-pharyngeus.
5. *Posterior Cervical Region.*
   - Trapezius.
   - Rhomboideus.
   - Splenius.
   - Complexus major.
   - Complexus minor, or Trachelo-mastoideus.
6. *Lateral Cervical Region.*
   - Scalenus anticus.
   - Scalenus posticus.

V. *MUSCLES OF THE PELVIS.*

1. *Region of the Anus.*
   - Levator ani.
   - Coccygeus.
   - Sphincter ani.
2. *Genital Region.*
   - *a.* IN MAN.
     - Erector penis.
     - Accelerator urinæ.
     - Transversus perinæi.
   - *b.* IN WOMAN.
     - Erector clitoridis.
     - Constrictor vaginæ.

VI. *MUSCLES OF THE ABDOMEN.*

1. *Abdominal Region.*
   - Obliquus abdominis externus.
   - Obliquus abdominis internus.
   - Transversus abdominis.
   - Rectus abdominis.
   - Pyramidalis.
2. *Lumbar Region.*
   - Quadratus lumborum.

MUSCLES OF THE EXTREMITIES.

I. *MUSCLES OF THE SUPERIOR EXTREMITIES.*

A. MUSCLES OF THE SHOULDER.

1. *Posterior Scapular Region.*
   - Supra-spinatus.
   - Infra-spinatus.
   - Teres minor.
   - Teres major.

2. *Anterior Scapular Region.*
   - Subscapularis.
3. *External Scapular Region.*
   - Deltoides.

B. MUSCLES OF THE ARM.

1. *Anterior Brachial Region.*
   - Coraco-brachialis.
   - Biceps flexor.
   - Brachialis internus.
2. *Posterior Brachial Region.*
   - Triceps extensor.

C. MUSCLES OF THE FORE-ARM.

1. *Anterior and Superficial Anti-brachial Region.*
   - Pronator teres.
   - Flexor carpi radialis.
   - Palmaris longus.
   - Flexor carpi ulnaris.
   - Flexor digitorum perforatus.
2. *Anterior and Deep Anti-brachial Region.*
   - Flexor digitorum perforans.
   - Flexor longus pollicis.
   - Pronator quadratus.
3. *Posterior and Superficial Anti-brachial Region.*
   - Extensor digitorum communis.
   - Extensor minimi digiti.
   - Extensor carpi ulnaris.
   - Anconeus.
4. *Posterior and Deep Anti-brachial Region.*
   - Extensor ossis metacarpi pollicis.
   - Extensor Primi internodii pollicis.
   - Extensor Secundi internodii pollicis.
   - Indicator.
5. *Radial Region.*
   - Supinator longus.
   - Supinator brevis.
   - Extensor carpi radialis longior.
   - Extensor carpi radialis brevior.

D. MUSCLES OF THE HAND.

1. *External Palmar Region.*
   - Abductor pollicis.

Opponens pollicis.
Flexor brevis pollicis.
Adductor pollicis.

2. *Internal Palmar Region.*
   - Palmaris brevis.
   - Abductor minimi digiti.
   - Flexor brevis minimi digiti.
   - Opponens minimi digiti, or Adductor minimi digiti.
3. *Middle Palmar Region.*
   - Lumbricales.
   - Interossei.

II. *MUSCLES OF THE INFERIOR EXTREMITIES.*

A. MUSCLES OF THE HAUNCH AND THIGH.

1. *Gluteal Region.*
   - Glutæus maximus.
   - Glutæus medius.
   - Glutæus minimus.
2. *Iliac Region.*
   - Iliacus internus.
3. *Pelvi-trochanteric Region.*
   - Pyriformis.
   - Obturator internus.
   - Obturator externus.
   - Gemellus superior.
   - Gemellus inferior.
   - Quadratus femoris.
4. *Anterior Crural Region.*
   - Sartorius.
   - Rectus femoris.
   - Triceps extensor.
5. *Posterior Crural Region.*
   - Semi-tendinosus.
   - Semi-membranosus.
   - Biceps femoris.
6. *Internal Crural Region.*
   - Pectineus.
   - Gracilis.
   - Adductor magnus.
   - Adductor longus.
   - Adductor brevis.
7. *External Crural Region.*
   - Tensor vaginæ femoris

B. MUSCLES OF THE LEG.

1. *Anterior Region of the Leg.*
    - Tibialis anticus.
    - Extensor proprius pollicis pedis.
    - Extensor longus communis digitorum pedis.
    - Peroneus tertius.
2. *Posterior and Superficial Region of the Leg.*
    - Triceps extensor pedis, including and { Gastrocnemius externus / Soleus.
    - Plantaris.
    - Popliteus.
3. *Posterior and Deep Region of the Leg.*
    - Flexor communis longus digitorum pedis.
    - Tibialis posticus.
    - Flexor longus pollicis pedis.
4. *Peroneal Region.*
    - Peroneus longus.
    - Peroneus brevis.

C. MUSCLES OF THE FOOT.

1. *Dorsal Region of the Foot.*
    - Extensor brevis digitorum pedis.
2. *Middle Plantar Region.*
    - Flexor brevis digitorum pedis.
    - Musculus accessorius.
    - Lumbricales.
3. *Internal Plantar Region.*
    - Adductor pollicis pedis.
    - Flexor brevis pollicis pedis.
    - Abductor pollicis pedis.
    - Transversus pedis.
4. *External Plantar Region.*
    - Abductor minimi digiti.
    - Flexor brevis minimi digiti.
5. *Interosseous Region.*
    - Interossei pedis dorsales.
    - Interossei plantares.

CHAPTER SECOND.

OF THE MUSCLES IN PARTICULAR.

MUSCLES OF THE TRUNK.

I. *MUSCLES OF THE VERTEBRAL COLUMN.*

1. *Anterior Vertebral Region.*

OF THE LONGUS COLLI.

(*M. Predorso-atloidien*, Chauss; *M. Longus Colli*, Soemm.)

802. The *Longus Colli* is a flat, narrow, elongated muscle, broader above than below, and in the middle than at the extremities, lying on the anterior lateral part of the bodies of the vertebræ, from the atlas to the third dorsal vertebra inclusive, and formed of two fasciculi which are in a manner superimposed upon each other. One of these is superior, directed obliquely outwards, extended from the anterior tubercle of the atlas, where it takes its origin by aponeurotic fibres, to the transverse processes of the third, fourth, and fifth cervical vertebræ, at the fore part of which it terminates by small aponeuroses. The other fasciculus is inferior. It descends vertically from the body of the axis and that of the third cervical vertebra, and from the anterior tubercle of the fourth or fifth cervical vertebra, whence it rises by aponeuroses, as far as the bodies of the last four cervical vertebræ and of the three first dorsal, to which it is attached by more or less distinct aponeurotic fibres, which are also inserted into the fibro-cartilages and the base of the transverse processes.

803. Its *anterior surface* is covered by the rectus capitis anticus major, the pharynx, the carotid artery, the pneumo-gastric nerve, and the communicating cords of the cervical ganglia and the œsophagus. The *posterior surface* covers the vertebræ to which it is attached, as well as their fibro-cartilages. Opposite the body of the two first dorsal vertebræ, its *outer edge* is separated from the scalenus anticus by a triangular interval which lodges the vertebral artery and vein. Its *upper extremity* is confounded with that of the muscle of the opposite side.

804. The aponeuroses, which give origin to this muscle, or

which terminate it, are prolonged before the fleshy fibres or even in their substance, and the latter, which are placed obliquely between them, are very short, notwithstanding the general length of the muscle.

805. The longus colli feebly bends the cervical vertebræ on each other and on the dorsal vertebræ. If the upper portion acts by itself and on one side only, it determines a rotation of the atlas upon the axis, and consequently of the head upon the neck.

OF THE PSOAS PARVUS.

(*M. Prelombo-pubien*, Chauss.; *M. Psoas Minor*, Soemm.)

806. The *Smaller Psoas* does not always exist. It is situated to the outer and fore side of the psoas magnus, over which it is applied. It is flat, thin, and narrow. Its *upper extremity* is attached by short aponeuroses, to the lower part of the body of the last dorsal vertebra and to the fibro-cartilage which separates it from the first lumbar vertebra, and it sometimes sends a small tendon to the transverse process of the twelfth vertebra of the back. The fleshy fibres, which do not form more than the upper third of the length of the muscle, cease opposite the fourth lumbar vertebra, after forming a bundle which is directed outwards and downwards, and are replaced by a flat tendon which becomes broader as it descends, and which turns over the psoas magnus, passing to its inner part. This tendon, which occupies of itself two-thirds of the extent of the muscle, terminates at the ilio-pectineal eminence (398) and the neighbouring part of the body of the pubis, sending to the fascia lata a broad and thin membranous prolongation, which covers the united tendon of the iliacus and psoas magnus.

807. The *anterior surface* of the psoas parvus is covered above by the diaphragm, afterwards by the renal vessels and nerves and by the peritoneum, and below by the external iliac artery. The *posterior surface* is united in its whole extent to the psoas magnus by cellular tissue.

808. When the two smaller psoæ act simultaneously, they bend the vertebral column on the pelvis, or the latter upon the vertebral column. If only one of them contract, the same motion takes place, but obliquely. In standing, they prevent the trunk from falling backwards. They also strengthen the crural arch, and are capable of stretching it in a certain degree.

OF THE PSOAS MAGNUS.

(*Prelombo-trochantinien*, Chauss.; *Psoas Major*, Soemm.)

809. The *Psoas magnus* is situated on the side of the vertebral column at its lower part, and along the upper strait of the pelvis, extending to the upper and fore part of the thigh. It is larger than the preceding, and is never wanting. It is of an elongated form, thicker in the middle than at the extremities. It is rounded at its

middle part, but at its upper part is thin and flat, and tendinous at the lower.

It arises, by short aponeuroses, from the lateral and inferior part of the body of the last dorsal vertebra, from a small portion of the posterior extremity of the twelfth rib, from the side of the bodies of the four first lumbar vertebræ, from the fibro-cartilages which separate them, and from the base of the corresponding transverse processes. Between the latter insertion and the others, there exists a space in which are lodged the branches of nerves which concur to form the lumbo-abdominal plexus. The fleshy body forms at its upper part a flat and nearly vertical bundle, which becomes rounded as its descends, and which afterwards directs itself towards the sides of the upper strait of the pelvis, where it gives rise, near the crural arch, to a very strong tendon. This tendon is placed at the inner side of the muscle before being totally separated from it, and is even concealed among its fleshy fibres, until close to the lumbar vertebræ. It receives, by its outer side, the fleshy fibres of the iliacus internus, passes under the crural arch, in the notch observed between the ilio-pectineal eminence and the anterior and inferior iliac spine, descends inwards and backwards, over the capsule of the femur, and terminates by embracing the trochanter minor.

810. The *external surface* of the psoas magnus, which is at the same time *anterior*, corresponds to the diaphragm, the peritoneum, the kidney, and the psoas minor when it exists. At the lowest part, this surface becomes entirely anterior, and is covered by the external iliac artery, the cellular tissue of the bend of the groin, then by the crural artery, and the corresponding vein. Its *inner surface*, which is applied upon the sides of the bodies of the lumbar vertebræ, and upon those of the corresponding intervertebral fibro-cartilages, is yet separated from these parts by the lumbar nerves and vessels. It leaves between it and the fifth lumbar vertebra a triangular interval, filled with cellular tissue. Then, becoming narrower, it is in contact with the external iliac vein and the tendon of the psoas parvus, and descends parallel to the pectineus, from which it is separated, at the lowest part, by the internal circumflex vessels. Its *posterior surface* is applied above upon the quadratus lumborum, from which it is separated by the lumbar nerves and the anterior lamina of the aponeurosis of the transversus abdominis. Farther down, it is connected with the iliac bone and the capsular ligament of the hip joint. (707.)

811. *Synovial Bursa.* A loose synovial membrane, of great extent, but scantily supplied with synovia, forming a sort of bag which descends to near the small trochanter, separates the branch of the pubes and the capsular ligament of the thigh-joint, from the tendon of the psoas magnus, which it embraces behind.

812. The psoas magnus bends the thigh on the pelvis, directing the point of the foot a little outwards. It acts, especially in the standing posture, by retaining the body when it tends to fall backwards, and it can even bend the pelvis and vertebral column on the inferior extremity. This flexion is direct when the muscles of both

sides contract at once. When one only acts, it is oblique. It is also one of the muscles that perform a principal part in walking.

2. *Posterior Vertebral Region.*

OF THE INTERSPINALES CERVICIS.

(*M. Inter-cervicaux*, Chauss.; *M. Interspinales Cervicis*, Soemm.)

813. The *Interspinales cervicis* are twelve in number, and occupy, in two parallel rows, close to each other, the intervals between the spinous processes of the cervical vertebræ, from that of the atlas and axis, to that which exists between the last vertebra of the neck and the first of the back. Each space contains two. They are so many thin, flat, elongated, quadrilateral fasciculi, arising, by short aponeuroses, from the sides of the lower edge of the spinous process of the vertebra above, and terminating in the same manner at the upper edge of the vertebra below. Their *outer surface* is covered by the semispinalis colli; the *inner* is separated by cellular tissue from that of the opposite muscle.

814. The interspinales cervicis bring the spinous processes near each other, and thus contribute to the extension of the neck, and consequently to the projection of the head backwards.

OF THE INTERSPINALES DORSI ET LUMBORUM.

(*Portion du M. Transversaire epineux*, Boyer, Bich., &c. *du M. Sacro-spinal*, Chauss.)

815. These muscles are of two kinds. Some of them represent fleshy fasciculi of various length, which are applied upon the lateral surfaces of the spinous processes, from the third or fourth dorsal vertebra, to the first or second lumbar, and which present a multitude of variations, whether in their number, or in the manner in which they intersect each other. They arise by three, four, five, six, seven, or eight tendons, sometimes split, so much the longer and stronger the higher they are, from the spinous processes of the dorsal vertebræ, from the second to the ninth, or from the third to the fifth, sixth, seventh, or eighth. From these tendons arise the fleshy fibres, which form thin narrow fasciculi, broader in the middle than at the extremities, convex externally, concave inwards. After intermingling in various ways, and even sometimes after being almost entirely confounded, they terminate by four or five tendons, of which the lowest is the longest and strongest, and which are attached to the two or three last dorsal and the two first lumbar vertebræ. They frequently receive accessory fleshy fibres, which come to them from the longissimus dorsi.

The inter-spinales dorsi et lumborum of the second kind, are covered by the preceding. They are placed on each side of the interspinal ligament, under the form of small short flat fasciculi, which extend from one spinous process to the other, being inserted by short aponeuroses.

816. These muscles, by bringing nearer to each other the spinous processes to which they are attached, contribute to extend the vertebral column, and sometimes to incline it a little to either side, when only one series acts.

OF THE SEMISPINALIS DORSI AND MULTIFIDUS SPINÆ.

(*Portion Lombo-cervicale du Sacro-spinal*, Chauss.)

817. These muscles consist of a number of small fleshy fasciculi, situated at the inner part of each vertebral groove, from the axis to the posterior surface of the sacrum, extended deeply from the transverse processes to the spinous processes of all the vertebræ, frequently confounded with each other, and contracting more or less intimate unions with the interspinales dorsi et lumborum and longissimus dorsi. Of these muscular fasciculi, some are superficial, the others deep and covered by the former.

818. The *superficial* arise from the posterior and superior part of the summit of the transverse processes of the eleventh, tenth, ninth, eighth, seventh, and sometimes the sixth dorsal vertebræ, by five or six tendons, shorter and thicker in the lower, longer and more slender in the upper muscles. Each of them receives fleshy fibres which constitute a conical bundle, at first round and thick, then thin and narrow, and which are terminated by other tendons, flat, and larger than those of the origin, to the number of five, six, seven, or eight, which attach themselves to the lower and lateral part of the spinous processes of the three, four, or five first dorsal vertebræ, and of the two last cervical. Some of them have the superior tendons bifurcated or even divided into three or four branches, and attaching themselves to several spinous processes at once, intermingling with those of the neighbouring fasciculi.

819. The *deep* portion or multifidus spinæ consists of from twenty-five to twenty-seven bundles. They arise separately from three or four tubercles of the sacrum which correspond to the articular processes, from the sacro-iliac ligament, from the most remote part of the crista ilii, the articular processes of the lumbar vertebræ, the transverse processes of the dorsal, and the articular processes of the four last cervical vertebræ, by conical tendons, whose divergent fibres, after a short course, furnish the fleshy body, which ascends obliquely inwards, widening and becoming thicker, and is in a great measure confounded with the neighbouring bundles. These muscular fasciculi are much more distinct in the loins and neck, than in the back and behind the sacrum. Other tendons proceed internally from these fleshy bodies, and attach themselves to the lower edge of the spinous processes of the sacrum, of all the lumbar and dorsal vertebræ, and of the six last cervical, in such a manner that each of them is disposed over several vertebræ by

fasciculi of different lengths, and terminates all at once at the third, fourth, and fifth vertebræ above that from which it arises. Each of the spinous processes also receives at the same time tendons from three or four of the fleshy bundles which are beneath it.

Pretty frequently also in the neck, other deeper bundles proceed from the transverse process of one vertebra to the spinous process and lower edge of the lamina of the one immediately above. But there is also observed, in this region, a superficial bundle, appearing isolated, which terminates in a very distinct point, at one of the tubercles of the summit of the spinous process of the axis, after being also fixed to that of the four next cervical vertebræ, and taking rise from the upper dorsal transverse processes.

820. The *posterior surface* of all these muscles is covered, in the neck, by the complexus magnus, the deep cervical artery, and the posterior branches of the cervical nerves; and in the back and loins, by the longissimus dorsi. The *anterior surface* covers the laminæ of the vertebræ, their transverse and articular processes, and the ligamenta flava. The *inner surface* is applied upon the spinous processes, the interspinales cervicis, and the dorsal and lumbar interspinal ligaments.

821. These muscles have nearly the same uses as the sacro lumbalis and longissimus dorsi; but they have also some peculiar to themselves. In the standing posture, they balance the vertebral column upon the pelvis, by their sacral and lumbar fasciculi, which, by contracting, furnish also solid points of support for the dorsal and cervical fasciculi. Moreover, by acting on one side, they produce a slight lateral inflection with rotation of the vertebral column; or they may also impress motion of rotation on any particular vertebra, according as an individual fasciculus acts by itself.

OF THE SACRO-SPINALIS, OR LUMBO-COSTALIS, COMPREHENDING THE LONGISSIMUS DORSI AND SACRO-LUMBALIS.

822. The *Sacro-spinalis* constitutes a very strong and thick fleshy bundle, a little flattened, contracted below, and broader above, which fills the whole space that exists between the lower part of the sacrum and the twelfth rib, where it divides into two distinct branches, the one internal, and more voluminous, which is the *longissimus dorsi*, the other external, and more slender, which constitutes the *sacro-lumbalis*.

823. A broad, strong, dense, and thick aponeurosis, of a white and glistening appearance, formed of interlaced fibres, and separated from space to space by apertures traversed by nerves and vessels, covers the whole of this mass behind. Attached to the posterior part of the iliac crest, the sides of the notch which terminates the sacral canal, the whole middle ridge of the sacrum, the spinous processes of the lumbar and last dorsal vertebræ, as well as to the corresponding interspinal ligaments, this aponeurosis gives origin to the greater part of the fibres of this muscular mass, is prolonged

much higher on the longissimus dorsi than upon the sacro-lumbalis, and divides into a considerable number of narrow bands, whose neighbouring edges are connected by a more or less thin and transparent aponeurotic membrane.

824. But the fleshy mass of which we speak does not derive its origin from this aponeurosis alone: it arises from the sacrum by a pointed prolongation which covers the posterior surface of that bone from the end of the sacral canal, and which is particularly attached to its three upper transverse processes. It arises also, by small tendons, from the spinous processes of the three or four last vertebræ, from the sacro iliac ligament, and from the inner and posterior part of the crest of the ilium. From these different places the fleshy fibres ascend almost vertically.

825. *Internal Branch* or *Longissimus Dorsi.* This branch is extended at the posterior part of the trunk, from the preceding bundle to the upper part of the back, between the sacro-lumbalis and semispinalis dorsi. It is elongated, a little flattened, very thick and somewhat square below, slender, and terminating in a point above. It divides, as it ascends, into a great number of fleshy tongues, ending in tendons, which form two distinct rows, one externally on the side of the sacro-lumbalis, the other internally along the vertebral column.

The tongues of this latter row, which are larger than the others, and more distinct in the back than in the loins, have tendons so much the longer and more slender the higher they are, and are attached, to the number of sixteen or seventeen, to the transverse and articular processes of the lumbar vertebræ, and to the transverse processes of the vertebræ of the back. The tongues of the second row, on the contrary, are thinner, flat, and so much the longer and less fleshy the higher they are. They are in number nine, eight, or seven, and are attached near the articulation of the ribs with the transverse processes, to the lower edge of the last eleven ribs, or to eight of them only, the first three and the last three excepted, &c. presenting, moreover, many individual anomalies in their insertion. This attachment to the ribs takes place by means of small flat and almost aponeurotic tendons, which are particularly thin below, in which direction the tendons are more distant from the articulation than above.

Frequently also the longissimus dorsi sends a thin, slender elongated tendon, which ascends towards the neck and sometimes reaches the head,* or is confounded with one of the complexi or with the splenius.

826. The *internal surface* of the longissimus dorsi covers the semispinalis dorsi and multifidus spinæ, and is in contact with the complexus magnus and transversalis colli; the *external* is contiguous to the sacro-lumbalis; the *anterior* is applied upon the levatores costarum, the ribs, the transverse processes, the posterior costo-

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* Morgagni. *Adv. Anat.* II. p. 38.

transverse ligaments, the dorsal vessels and nerves, and a portion of the external intercostal muscles; lastly, the *posterior* surface corresponds to the aponeurosis of the obliquus internus and transversus of the abdomen, the inferior and superior serrati, the aponeurosis which goes from the one to the other, the latissimus dorsi, trapezius, rhomboideus, and splenius.

827. *External Branch* or *Sacro-lumbalis.* This branch extends from the transverse processes of the four or five last cervical vertebræ, to the bundle which is common to it with the preceding. It is elongated, thick, pyramidal, more developed below than above, separated from the longissimus dorsi merely by an adipose line, and directed somewhat obliquely from below upwards and from within outwards.

The fleshy fibres of the sacro-lumbalis which come from the common mass, that is to say, from the posterior part of the iliac crest and from the aponeurosis, ascend almost vertically and terminate at the six last ribs by five, six, or seven flat tendons, which are inserted below the angle of these ribs.

Twelve other small internal, elongated, slender tendons, so much the shorter and thicker the lower they are, are inserted above the angle of all the ribs. Each of them gives rise to a fleshy bundle, which is confounded with those in its vicinity, after having ascended obliquely upon the angle of the ribs. These bundles continue the body of the muscle, which without them would cease at the middle of the thorax. After uniting with each other, these processes ascend obliquely outwards and terminate in tendons at first united by their neighbouring edges, so as to form a sort of membrane, then isolated, and becoming longer and more slender the higher they are. These tendons, which cover the posterior surface of the fleshy bundles, are attached below the angle of the upper ribs and to the tuberosity of the first, as well as to the summit of the last four or five transverse processes of the neck.*

828. The posterior surface of the sacro-lumbalis has the same connections as those of the longissimus dorsi. The *anterior surface* covers the aponeurosis of the transversus abdominis, the ribs, the external intercostal muscles, the longissimus dorsi and transversalis colli. The *inner surface*, is applied against the longissimus dorsi, being only separated from it by branches of the dorsal nerves. Its *outer edge*, between the pelvis and thorax, corresponds to the point of junction of the posterior and middle laminæ of the aponeurosis of the transversus abdominis.

829. The sacro-spinalis prevents the vertebral column from yielding to the weight of the organs placed before it and which would tend to drag it forwards. It bends it backwards when it acts in conjunction with that of the opposite side, and laterally, when acting singly. The sacro-lumbar branch may serve to de-

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* This portion of the muscle, attached to the transverse processes of the cervical vertebrae, is almost universally described by British writers under the name of *Cervicalis descendens.*

press the lower ribs in particular, or to raise the upper, according as it acts from the lumbar region or from the cervical. The longissimus dorsi fixes the transverse processes, tending to lower them upon the pelvis, and concurs in this manner, with the semi-spinalis dorsi and multifidus spinæ to keep the vertebral column erect.

OF THE TRANSVERSUS CERVICIS, OR TRANSVERSALIS COLLI.

830. The *Transversus Cervicis* is situated on the posterior and lateral parts of the neck and the upper part of the back. It is slender, elongated, flattened from within outwards, thinner at its extremities than in the middle, and arises, most commonly, by six small tendons, from the transverse processes of the eighth, seventh, sixth, fifth, fourth, and third dorsal vertebræ. These tendons are so much the longer the lower they are, and cross at right angles those of the longissimus dorsi. They ascend almost vertically, and are replaced by fleshy tongues which cover each other and are mutually confounded. These tongues, in their turn, are terminated by tendons similar to the preceding, but so much longer the higher they are. They are accompanied by the fleshy fibres as far as their insertion, and are attached below the posterior tubercle of the transverse processes of the sixth, fifth, fourth, third, and second cervical vertebræ, so that the muscle is not connected with the two first dorsal or the last cervical vertebra.

831. The *posterior edge* of the transversus cervicis is almost confounded above with the small complexus muscle. In the middle, it is covered by the lévator anguli scapulæ, and the serratus posticus superior; and below, by the longissimus dorsi, with which it is also in part confounded. Its *anterior edge* covers the transverse processes of the vertebræ, from the second cervical to the eighth dorsal. Its *outer surface*, which inclines a little backwards, corresponds to the splenius, levator anguli scapulæ, and sacro-lumbalis; the *inner* is applied upon the complexi, and part of the semi-spinalis dorsi.

832. The transversus cervicis extends the vertebræ of the neck, and inclines them to either side.

3. *Lateral Vertebral Region.*

OF THE INTER-TRANSVERSALES COLLI.

833. The *Inter-transversales Colli* are small, quadrilateral, thin, flat bundles, placed two and two in the intervals of the transverse processes of the neck, excepting between the first and second, where there is only one. They are distinguished into anterior and posterior: the former are six in number, the latter five. The two muscles of each interval are attached separately, the one to the anterior, the other to the posterior edge of the groove, which is observed on the transverse process below. They then ascend parallel to each other, and separated by the anterior branches of the

cervical nerves, to be attached to the lower part of the transverse process above. These insertions take place by means of short aponeurotic fibres. The *anterior* inter-transversales colli are covered anteriorly by the rectus capitis anticus major. The *posterior* are covered behind by the splenius, transversalis colli, and sacro-lumbalis.

834. These muscles draw the transverse processes of the neck toward each other, and contribute to the lateral inflexions of that part of the body.

OF THE INTER-TRANSVERSALES LUMBORUM.

835. These muscles, which are all fleshy, and are in number ten, five on each side, resemble the preceding in their general disposition, only they are more distinct, and are not placed in two rows, each inter-transverse space containing only one. The first occupies the interval which exists between the transverse processes of the first lumbar, and the last dorsal vertebra: and the last occurs between those of the fourth and fifth lumbar vertebræ. Their *posterior surface* corresponds to the sacro-lumbalis; the *anterior* to the quadratus lumborum. Their *lower* and *upper* edges are attached to the corresponding edges of the neighbouring transverse processes, by means of very short aponeurotic fibres.

836. These muscles bend laterally the lumbar region of the vertebral column, or raise it when it is inclined to the opposite side. They act, however, but feebly, on account of their weakness, and the closeness of their points of attachment and termination.

II.—MUSCLES OF THE CHEST.

1. *Anterior Thoracic Region.*

OF THE PECTORALIS MAJOR.

(*M. Sterno-humeral*, Chauss.)

837. The *Pectoralis major* is a very large, flat muscle, of a triangular form, with rounded angles, and much narrower and thicker externally than internally. It is situated at the fore part of the thorax, and before the axilla. It arises from the inner half of the clavicle, from the anterior surface of the sternum, the cartilages of the true ribs, excepting the first, and over an extent so much the larger the lower these attachments are, from a small part of the bony portion of the fifth rib, and lastly, from an aponeurosis which forms a continuation of that of the abdomen.

838. The part which arises from the clavicle is attached to that bone by short aponeurotic fibres; but, upon the sternum, there are observed longer aponeuroses, which are thin, with loose radiating fibres, interlaced with those of the opposite muscle. At the

lowest part, the insertions of the pectoralis major are confounded with the obliquus abdominis externus and sometimes with the rectus.

839. Succeeding these different aponeurotic attachments, which describe internally a sort of curved line of great extent, the fleshy fibres approach each other, proceeding outwards, and following a different direction. Those of the clavicle, which are the shortest, are a little inclined downwards, and constitute a bundle, thick at its commencement, and separated from the rest of the muscle by a cellular line. Those which arise from the upper part of the sternum, and from the cartilages of the five first ribs, are a little longer, and proceed horizontally. Lastly, the lower, which are the longest, proceed obliquely upwards, and approach the more to the vertical direction the lower they are.

840. These fleshy fibres, by gradually converging toward each other, render the muscle very strong and thick at its outer part. There they cover each other, in such a manner, that the upper are placed more superficially than the lower; and they give rise to a kind of tendon, which fixes the muscle to the humerus. This tendon, which is much broader than it seems to be at first sight, is folded upon itself from before backwards, and from below upwards, and is thus composed of two laminæ, placed one before the other, separated above, and united below. The posterior lamina, which is broader, receives the inferior fleshy fibres of the muscle, which cross the direction of the superior fibres. Above, it sends off an aponeurotic prolongation, which ascends before the bicipital groove of the humerus to unite, upon the larger tuberosity of that bone, with the tendon of the supra-spinatus, and it sends into the same groove a fibrous lamina, which is confounded with that which lines it after being detached from the tendon of the teres major and latissimus dorsi. The two laminæ of the tendon of the pectoralis major, are at first separated by cellular tissue, but afterwards intimately unite, and are inserted together into the anterior lip of the bicipital groove, sending off from their upper edge a considerable number of fibres to the brachial aponeurosis.

841. The *anterior surface* of the pectoralis major is covered above by the platysma myoides, at the middle by the corresponding mamma, and in the rest of its extent by the skin. Its *posterior surface* covers, from within outwards, a part of the cutaneous region of the sternum, the cartilages of the true ribs, and a part of their bony portion, the thoracic vessels and nerves, the subclavius muscle, the pectoralis minor, inter-costales externi, serratus magnus rectus abdominis and obliquus abdominis. Toward the hollow of the axilla, this surface is in contact with a great quantity of adipose cellular tissue, with lymphatic ganglions, the axillary vessels, and the nerves of the brachial plexus. Close to its insertion into the humerus, it passes before the coraco-brachialis and biceps. It is separated from all these parts by a layer of cellular tissue, which becomes so much the thicker the nearer it is to the axilla. The *inner edge* of the pectoralis major is confounded with that of

the opposite muscle as far as the level of the ensiform cartilage, and is then gradually lost in the linea alba of the abdomen. Its *upper edge* is contiguous externally with the deltoid muscle, from which it is separated by an interval broader above than below, and in which the cephalic vein is lodged in the midst of cellular tissue. Lastly, its *inferior edge*, which is thin internally, and much thicker externally and at the upper part, forms, above, the anterior edge of the hollow of the axilla.

842. The pectoralis major has two very different modes of action. It moves the arm, or contributes to respiration by acting upon the ribs. When the arm is hanging by the side of the body, it carries it inwards and forwards; when it is raised, it lowers it; when in rotation outwards, it turns it inwards. Its clavicular bundle entering into action by itself, slightly raises the humerus. The opposite effect is produced by its lower fibres, which also depress the tip of the shoulder.

On the other hand it acts upon the thorax, when the humerus is fixed. It then draws the ribs and sternum upwards, which renders it a muscle of inspiration. It can even raise the trunk upon the limbs, as in the action of seizing the branches when one is climbing a tree, &c.

OF THE PECTORALIS MINOR.

(*M. Costo-coracoidien*, Chauss.)

843. The *Pectoralis minor* is situated at the upper and fore part of the thorax, behind the preceding muscle. It is thin, flat, triangular, and much smaller than the pectoralis major. It is attached by its base, which is directed inwards, to the upper edge and outer surface of the third, fourth, and fifth ribs, by three or four thin and rather broad aponeurotic laminæ, which are continuous with the fibrous plane that covers the external intercostal muscles. The lowest of these digitations is also the largest. On leaving these aponeuroses, the fleshy fibres ascend convergingly upwards and backwards, so that the muscle becomes gradually narrower at the same time that it increases in thickness. Towards the axilla, they give rise to a tendon, which is much sooner apparent anteriorly and below than posteriorly and above, and which is attached to the anterior part of the inner edge of the coracoid process as far as its summit, where it unites with the coraco-brachialis and biceps.

844. The *anterior surface* of the pectoralis minor is covered by the pectoralis major. Between them is a layer of adipose cellular tissue, in which are contained some of the thoracic vessels and nerves. Frequently a very small portion of this surface extends beyond the pectoralis major, and is covered by the skin. Its *posterior surface* is applied upon the ribs, the external intercostal muscles, the serratus magnus, the axillary vessels, and the brachial plexus. Its *upper edge* is shorter than the lower.

845. The pectoralis minor draws the shoulder forwards and

downwards, and carries the lower angle of the scapula backwards. It may act upon the ribs in the same manner as the pectoralis major.

OF THE SUBCLAVIUS.

(*Costo-claviculaire*, Chauss.)

846. The *Subclavius* is a small round fusiform muscle, slightly compressed from before backwards, slender at its extremities, which are tendinous and bulging in the middle, which is fleshy. It is extended obliquely at the upper and fore part of the thorax, between the cartilage of the first rib and the clavicle. It originates from the cartilage and sometimes even from the osseous part of the rib, before the costo-clavicular ligament, by a flat tendon, which, after being prolonged behind the fleshy body, loses itself in its interior. It then ascends obliquely outward and backwards, and is lodged in the groove which is observed at the lower surface of the clavicle. It then terminates by aponeurotic fibres, which proceed outwards to the coraco-clavicular ligament, and frequently to the coracoid process itself.

847. The *anterior surface* of the subclavius muscle is covered by the pectoralis major. Between them, however, there is seen a thin aponeurosis, of a variable and irregular form, which is only absolutely connected with the bony parts, and which descends from the clavicle and coracoid process towards the first ribs. Its *posterior surface* is applied upon the axillary vessels and the nerves of the brachial plexus. It corresponds to a triangular space, circumscribed by the sterno-cleido-mastoideus and trapezius. Its *lower edge* is free, and separated from the first rib by the axillary vessels and brachial plexus; the *upper* is fixed to the clavicle in its two lower thirds.

848. This muscle lowers and carries forward the clavicle, and consequently the tip of the shoulder. It can also, by an opposite action, raise the first rib.

2. *Lateral Thoracic Region.*

OF THE SERRATUS MAGNUS.

(*Costo-scapulaire*, Chauss.)

849. The *Serratus magnus*, which is situated on the sides of the thorax, partly concealed by the shoulder, is very broad, thin, and flat, of an irregularly quadrilateral form. It is terminated anteriorly by a curved and dentated edge, formed of fleshy digitations attached to the outer surface of the first eight or nine ribs, by as many small tendinous or merely aponeurotic cords. These digitations are not all alike. The first, which is very short, broad, thick, and very distinctly separated from the others, is attached to the lower part of the outer surface of the first rib, to the upper part of that of

the second, and to an aponeurosis placed between them, and is sometimes confounded with the scalenus posticus. The second is broad and thin, and arises from an oblique line upon the second rib. The third and fourth are a little narrower, and are attached to the corresponding ribs, upon similar ridges running obliquely from above downwards, and from behind forwards. The last digitations, which are narrow and so much the longer the lower their situation is, originate together from the outer surface and upper edge of the fifth, sixth, seventh, and eighth ribs, and intermingle with the digitations of the obliquus externus abdominis.

850. Each of these digitations furnishes to the body of the muscle a more or less distinct bundle. The union of these bundles, which are distinctly separated below by intervals filled with adipose tissue, seems to give rise to a division of the muscle into three portions. The first of these portions, which is superior, thick, narrow, and short, comes from the two first ribs, and ascends to the posterior angle of the scapula, where it terminates by uniting with the levator anguli scapulæ. The middle portion, which is broad and thin, proceeds, in a horizontal direction, from the second, third, and fourth ribs, to the vertebral edge of the scapula, where it is inserted by short aponeuroses, between the rhomboideus and subscapularis. The third or inferior portion, which is thick, broad, and radiated anteriorly, and contracted posteriorly, ascends obliquely from the last digitations towards the lower fourth of the same edge, and the inferior angle of the scapula, on the anterior surface of which it particularly terminates.

851. By its *external surface*, the serratus magnus is in relation at its lower and fore part with the skin; posteriorly and below, with the latissimus dorsi, but higher up with the subscapularis; above and before, it is covered by the two pectoral muscles, the axillary vessels, and the brachial plexus. By its *inner surface*, it is applied upon the first seven or eight ribs, the corresponding external intercostals, and a portion of the serratus posticus superior.

852. The motions which the serratus magnus may induce are of two kinds, the one belonging to the scapula, the other to the thorax. When the three portions act simultaneously, it moves the scapula forwards; its first portion contributes to the depression of the tip of the shoulder; while its lower portion, on the contrary, raises it, by drawing the inferior angle of the bone forwards, and enters especially into action when heavy burdens are raised. If the scapula has been originally fixed by the trapezius, rhomboideus, and levator anguli, it becomes a muscle of inspiration, by drawing the ribs outwards and upwards.

OF THE LEVATOR ANGULI SCAPULÆ, ANGULARIS SCAPULÆ.

(*Trachelo-scapulaire*, Chauss.)

853. This long and thick muscle is situated at the lateral and posterior part of the neck. It is longer posteriorly than anteriorly, and broader below than above. It is attached to the posterior tubercle

of the transverse processes of the first three or four cervical vertebræ, by as many small tendons, frequently united with the splenius and scalenus posticus. Each of these tendons gives rise to a fleshy bundle. That of the atlas is the longest and thickest. The others become longer as they are more inferior. They are at first isolated, but unite below into a single bundle, which descends obliquely backwards and outwards to be inserted by short tendinous fibres, into the posterior angle of the scapula, and the inner part of its upper edge. There it is evidently confounded with the serratus magnus, which has induced M. Dumeril to consider it as a fourth portion of that muscle, an opinion which derives additional weight from the anatomy of quadrupeds.

854. Its *outer surface* is covered at its upper part by the sterno-cleido-mastoideus, in the middle by the skin, and below by the trapezius. The *inner surface* is applied upon the serratus posticus superior, sacro-lumbalis, transversalis colli and splenius. Its *posterior edge* covers a portion of the upper edge of the rhomboideus.

855. This muscle depresses the tip of the shoulder by raising the posterior angle of the scapula, which it causes to perform a rotatory motion. When it acts in concert with the trapezius, the shoulder is directly raised. It may also incline the neck to its side, or fix it in the erect position, when it acts in conjunction with its fellow.

3. *Intercostal Region.*

OF THE INTERCOSTALES EXTERNI.

(*M. Inter-costaux externes*, Chauss.)

856. These muscles are twelve in number, and are situated in the intercostal spaces, from the vertebral column to the union of the ribs with their cartilages. They are thin, and borrow their form and breadth from each of the spaces which receive them. Their fibres, which seem to be continued anteriorly by very delicate aponeuroses, whose fasciculi are prolonged as far as the sternum, are attached above to the outer lip of the lower edge of the rib above, and posteriorly to the transverse process of the vertebra with which that rib is articulated. Tendinous bundles are prolonged between them, and multiply their points of insertion. They descend from thence obliquely inwards and forwards, and terminate at the upper edge of the lower rib, partly in the periosteum and partly in small aponeuroses with which they are interlaced. Those of the upper intercostal muscles are less oblique than those of the lower, and they are more so posteriorly than before.

857. Their *outer surface* is covered by the two pectoral muscles, the serratus magnus, obliquus externus abdominis, serratus posticus, superior and inferior, sacro-lumbalis, and longissimus dorsi. The *inner* surface covers the pleura from the tuberosity to the angle of the ribs. In the rest of its extent, it is applied upon the corresponding internal intercostal muscle, from which it is separated by a thin layer of cellular tissue, and above by the intercostal vessels and nerves.

OF THE INTERCOSTALES INTERNI.

(*M. Inter-costaux internes*, Chauss.)

858. These are also twelve in number, and correspond to the external intercostal muscles in form and breadth, differing however in only extending from the angle of the ribs to the sternum. Their fleshy fibres are equally intermingled with aponeuroses; but they descend obliquely backwards, and are inserted above into the inner lip of the lower edge of the ribs and of their cartilages, and below into the fore part of the upper edge of the ribs and cartilages. They are less oblique than those of the external intercostal muscles.

859. Their *outer surface* is covered by the preceding muscles, and is in connection with the intercostal vessels and nerves. The *inner surface* is lined by the pleura, and a thin layer of a nearly fibrous cellular tissue.

860. The intercostales externi and interni have the same uses; they raise or depress the ribs, in the motion of inspiration or expiration, according as the upper or lower rib is the point from which they act.

OF THE LEVATORES COSTARUM.*

861. Each rib receives from the summit of the transverse process situated above that with which it is articulated, a small, flat, thin, triangular fleshy bundle. These small muscles, to the number of twelve, form a series which extends along the posterior part of the trunk. They are directed obliquely downwards and forwards, and are attached by aponeuroses intermingled with the fleshy fibres, to the upper edge of the rib below, and occasionally to that of the next, by means of an appendage which passes over the posterior costo-transverse ligament. The upper are smaller and thinner than the lower.

862. There are also observed, in various places of the inner surface of the thorax, small muscular planes, which vary much in respect to number, size, and situation. They descend obliquely backwards from one rib to that which is beneath, or to that which follows it. They have been designated by the name of *Infracostales*.

863. These small muscles assist in raising the ribs, and are therefore subservient to inspiration.

OF THE TRIANGULARIS STERNI.

(*M. Sterno-costal*, Chauss.)

864. The *Triangularis Sterni* is a thin, triangular, flat muscle, situated within the thorax, behind the cartilages of the

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* M. M. Boyer and Chaussier consider these as appendages of the external intercostal muscles.

second, third, fourth, fifth, and sixth ribs. It arises from the edge of the ensiform cartilage and sternum, up to the articulation of that bone with the fourth cartilage, by means of aponeurotic fibres which are prolonged a great way among the fleshy fibres. From thence it ascends outwards, to be attached by so many distinct digitations to the cartilages of the ribs mentioned, as well to their edges as to their inner surface. These digitations are so much the larger and less ascending, the lower they are observed. The variations which this muscle presents are extremely numerous.

865. Its *anterior surface* is covered by the cartilages of the four last true ribs, the inner intercostal muscles, and the internal mammary vessels. The *posterior surface* rests upon the pleura, and in a small part of its extent upon the diaphragm. Its *inferior edge* or *base* is contiguous to the transversalis abdominis.

866. It draws the cartilages of the ribs, to which it is attached, backwards, inwards, and downwards, and is consequently subservient to exspiration.

4. *Region of the Diaphragm.*

OF THE DIAPHRAGM,* OR SEPTUM TRANSVERSUM.

867. The diaphragm is a single, very broad, and membranous muscle, unequally curved in its different parts, situated obliquely between the thorax and abdomen, which it separates from each other. Its figure is nearly circular, although it is a little more extended in the lateral directions than from before backwards. It is fleshy at its circumference, aponeurotic in the middle, and forms a kind of elliptical arch, mobile and flexible, but not symmetrical, although it is placed in the median line of the body, which is a singular case in the system of the muscles subjected to the influence of the cerebral nerves.

868. We have said that the centre of the diaphragm was occupied by an aponeurosis, to which the fleshy fibres are attached, and which has been designated by the names of *Phrenic Centre*, *Tendinous Centre*, *Nervous Centre*, or *Cordiform Tendon.* Its breadth is considerable. It is distinctly notched behind towards the vertebral column, and anteriorly is three lobed, on which account it has been compared to a trefoil leaf. Of the three lobes of this aponeurosis, the middle is the largest, the right is a little less, and the left is the smallest. Some variations, however, are observable in this respect.

869. The fibres of the aponeurosis of the diaphragm, which are larger in men than in women, and more distinct in old than in young persons, are all of different lengths and directions. In their general disposition, however, they are radiated, proceeding from the posterior notch to the circumference of the lobes; but they are

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* Διαφϱαγμα, septum, a partition; δια, inter; φϱασσω, claudo.

interlaced a thousand times with each other, and with more superficial and looser laminæ, which occur at the upper and under surfaces of the muscle, and which describe nearly transverse curves, an arrangement which is especially evident on the right side. They are white and shining, with a pearly and satiny lustre, and are denser toward the upper surface of the aponeurosis than toward the lower.

Between the right and middle lobes, near the vertebral column, is an aperture of a square form, with unequal sides. It gives passage to the vena cava inferior, to which it adheres pretty strongly. Its anterior side is the shortest, and is not very distinct from the right, which is the longest. Each of its sides is formed by a particular layer of aponeurotic fibres, which are interlaced with the neighbouring layers at its extremities.

870. Besides this aperture for the vena cava inferior, there frequently occurs a hole for the diaphragmatic vein, and one or two other holes for the superior hepatic veins, which are also formed in the phrenic aponeurosis.

871. The fleshy fibres proceed from the whole circumference of this aponeurosis, to be directed forwards, laterally, and backwards.

872. The anterior fibres, which are very short and not numerous, are directed downwards and forwards, on the way to the xiphoid cartilage, where they terminate by short aponeurotic fibres. Between these fibres and those which come from the cartilage of the seventh rib, there is a triangular aperture with its base below, by which the cellular tissue of the thorax communicates with that of the abdomen. The size of this interval varies much, sometimes it is even wanting.

873. The lateral fibres are the most numerous. They arise from the right and left lobes, and proceed, diverging and curving backwards, toward the circumference of the base of the chest, and to be attached to the inner surface of the last six ribs, by digitations which are interlaced with those of the transversalis abdominis. The first of these digitations is attached to the outer half of the posterior surface of the upper edge of the cartilage of the seventh rib. The second, which is the longest of all, is inserted into the corresponding parts of the eighth rib; the other four, which become gradually shorter, are moreover slightly attached to the bony portion of the four last ribs.

Of these lateral fibres, the more posterior, which are the shortest, terminate in an aponeurotic bundle, extended between the extremity of the last rib and the base of the transverse process of the first lumbar vertebra. It has been named the *Ligamentum arcuatum Diaphragmatis*, and is nothing else than the upper edge and a replication of the anterior lamina of the aponeurosis of the transversalis abdominis, which covers a little the quadratus lumborum and the last intercostal nerve.

Lastly, in the two last intercostal spaces, the diaphragm is continued by common aponeurotic fibres, into the transversalis abdominis.

874. The posterior fibres, proceeding from the prevertebral notch of the aponeurosis, are directed in small numbers to a sort of aponeurotic arch, extended from the base of the transverse process of the first lumbar vertebra to the body of the second, and under which passes the upper part of the psoas muscle. But they unite for the most part into two thick bundles, which are named the *Pillars*, *Columns*, or *Crura of the Diaphragm.* Of these crura the *right* is longer, broader, and thicker, and is situated nearer the middle line of the vertebral column. It is attached to the bodies of the four first lumbar vertebræ, by as many tendinous digitations. The *left*, which is narrower, shorter, more slender, and situated more to the side, is only attached to the bodies of the three first lumbar vertebræ. These two crura leave at first between them a considerable separation, which constitutes a narrow, oblong aperture, a little broader before, situated toward the middle of the vertebral column, all fleshy in its circumference, and through which the œsophagus and pneumo-gastric nerves pass from the thorax to the abdomen. Immediately after, there is detached from each of them a fleshy bundle, which is interlaced with that of the opposite side, and of which the anterior, descending from the left column to the right, is the larger. These two bundles complete the lower part of the œsophageal aperture, and form the upper part of a new aperture of a parabolic form, which the two columns also leave between them; and which gives passage to the aorta, vena azygos, and thoracic canal. This aperture, which is situated more posteriorly and more to the left than the preceding, is further distinguished from it by having its margin aponeurotic and continuous with the tendons of the crura. On its sides and behind, are spaces left between the fleshy fibres, for the passage of the nervous cords, which form a communication between the thoracic ganglia and those of the abdomen.

875. The *upper* or *thoracic surface* of the diaphragm is convex and inclined backwards. Its middle part is strongly connected with the pericardium, and corresponds to the mediastinum. Its sides, which are lined by the pleura, support the base of the lungs. Anteriorly, it covers the triangularis sterni, on the sides the intercostales interni, and posteriorly the aorta and the psoas magnus and quadratus lumborum.

Its *inferior* or *abdominal surface* is concave in its whole extent, and a little inclined forwards; but its concavity is not regular, being always greater to the right than to the left, which appears to arise from the presence of the liver. In the middle it is nearly plain. Posteriorly, the kidneys, the renal capsules, the pancreas and the duodenum; on the right side, the liver; and on the left, the spleen and the stomach, are connected with it. In the rest of its extent, it is covered by the peritoneum, whence it results that the muscle is placed between two serous membranes, but is not furnished with a special envelope, as Bartholin has asserted.

On these two surfaces are distinctly seen vessels and nerves of considerable size which belong peculiarly to the diaphragm.

The *circumference* of the diaphragm, at the back part of the chest opposite the ensiform cartilage, is fixed by very narrow insertions; but on the sides, these insertions are about two inches and a half in breadth, whence there results that the upper surface of the diaphragm is really much smaller than the lower. This circumference corresponds, anteriorly, to the ensiform cartilage and the triangularis sterni; on the sides to the ribs and internal intercostal muscles; posteriorly to the vertebral column, the aorta, the thoracic canal, and the psoas and quadratus lumborum muscles.

876. The diaphragm separates the thorax from the abdomen, and serves to support the viscera which these great cavities contain. But it also performs motions, which, by varying the dimensions of these cavities, have the greatest influence upon many functions. When it contracts, the convexity which it forms in the thorax disappears; its fibres, from being curved, become straight; the aponeurotic centre acquires more obliquity; the thorax is thus enlarged, and the abdomen diminished. It is therefore in this case essentially a muscle of inspiration; and, in ordinary circumstances, it is even the only one that acts to produce inspiration. If its contraction is carried farther, it draws the ribs toward the vertebral column, which diminishes the transverse diameters of the thorax. When it relaxes, on the other hand, it resumes its former dimensions, ascends in the thorax, forms there the same arch, compresses the lungs, and thus contributes to exspiration. During contraction, the lateral parts of the diaphragm descend much more than the middle part, which is retained by the pericardium and mediastinum.

During the same action, the œsophagus is compressed, because the aperture through which it passes is entirely fleshy; but this does not happen to the vena cava, vena azygos, aorta and thoracic duct, the circumference of their apertures being aponeurotic.

The motions of the diaphragm also produce various remarkable phenomena, as *sighing*, *yawning*, *coughing*, *sneezing*, *laughing*, *sobbing*, and *hiccup*, which are all more or less connected with the motions of inspiration and exspiration. It is also subservient to smell in the action of snuffing odoriferous effluvia, and contributes to the formation of the voice in crying, singing, &c. By constantly pressing upon the abdominal viscera, it subjects them by its motions of elevation and depression to a tossing which is favourable to their functions. It also contributes essentially, when it contracts strongly, to vomiting, the excretion of the feces and urine, and the expulsion of the fetus. Lastly, the diaphragm has been considered by many physiologists as the principal seat of the passions.

5. *Vertebro-costal Region.*

OF THE SERRATUS POSTICUS SUPERIOR.

(*M. Dorso-costal*, Chauss.)

877. This muscle, which is situated at the upper part of the back, is of an irregularly quadrilateral form, flat and very thin. It is inserted below the superficial cervical ligament, into the spinous processes of the seventh, eighth, ninth, and sometimes the tenth vertebræ, by a very delicate aponeurosis, extending to the half of its length, that is to say, to the level of the outer edge of the splenius and sacro-lumbalis, and mingling a little with the insertion of the rhomboideus, trapezius and splenius. The fibres of this aponeurosis are parallel and directed obliquely from above downwards and from within outwards. The fleshy fibres follow the same direction, and separate into four digitations, which are attached to the outer surface and upper edge of the second, third, fourth and fifth ribs, removing farther from their angle the lower they are. Sometimes there are only three of these digitations; in other cases there are five. They always terminate by short aponeurotic fibres.

878. The *posterior surface* of this muscle is in connection with the rhomboideus, angularis scapulæ, serratus magnus and trapezius. The *anterior surface* is applied upon the splenius, longissimus dorsi, transversalis, sacro-lumbalis, the ribs and external intercostal muscles.

879. It raises the ribs to which it is attached, and is consequently subservient to inspiration. It also keeps down in some measure the vertebral muscles over which it passes.

OF THE SERRATUS POSTICUS INFERIOR.

(*M. Lumbo-costal*, Chauss.)

880. It is broader than the preceding, but is equally thin, and has nearly the same form. It is situated at the lower part of the back, in the lumbar region. Arising from the last two or three spinous processes of the back, and from the first three or four of the loins, as well as from the corresponding interspinal ligaments, by a broad aponeurosis, with parallel fibres directed obliquely upwards and outwards, which is partly confounded with that of the latissimus dorsi, it divides, after a short passage, into four very distinct bundles. The first, which is very broad, is attached to the outer lip of the lower edge of the second false rib, over an extent of four or five inches, and by its lower border covers the upper edge of the third. The other three, which become successively narrower and shorter, are attached in the same manner; but they are directed upon the ribs farther from the angle than the first, so that the fourth is attached not only to the bony part, but also to the cartilage of the last rib. Their edges also overlap each other, pre-

senting the appearance of *imbrication*, to use the language of botanists.

881. The *posterior surface* is covered by the latissimus dorsi. The *anterior* rests upon the three last ribs, the corresponding external intercostal muscles, and the posterior lamina of the aponeurosis of the transversalis abdominis, which separates it from the sacro-spinales.

882. It lowers the ribs to which it is attached, and thus contributes to exspiration. It is in some measure an antagonist of the preceding muscle.

OF THE VERTEBRAL APONEUROSIS.

883. The two muscles of the vertebro-costal region are united by an aponeurosis so thin as to be absolutely transparent, and almost to disappear by desiccation in contact with the air. It is fixed to the upper edge of the one and to the lower edge of the other; but it is also attached externally to the angles of the ribs, and internally to the spinous processes. Its form is consequently that of a very elongated quadrilateral plane. Its fibres are in general indistinct, and are interlaced with each other in the direction of the aponeurosis. At the upper and lower parts, however, there are some transverse fibres which are more distinct, and which run in a direction parallel to those of the serrati postici superiores muscles. This aponeurosis keeps down the vertebral muscles behind, which are thus inclosed in a sort of sheath, bony before, and membranous in the other directions.

6. *Posterior Thoracic Region.*

OF THE LATISSIMUS DORSI.

(*Lumbo-humeral*, Chauss.)

884. The *latissimus dorsi* is a broad, thin, flat muscle, very irregularly quadrilateral, situated upon the posterior, lateral, and inferior region of the trunk, extending from the lower part of the back to the arm, passing over the inferior angle of the scapula, and the posterior part of the axilla. The greater part of its fleshy fibres are inserted along the outer edge of a strong aponeurosis which is contracted at its upper part, but is very broad below, where it is confounded in part with that of the serratus posticus inferior, and the obliquus internus abdominis. This aponeurosis, which is formed of fibres interlaced in all directions below and following the direction of the fleshy fibres above, arises itself from the last five, six, seven, or eight spinous processes of the back, from all those of the loins and sacrum, from the asperities of the sacral grooves, and from the posterior part of the iliac crest, where it is continuous with aponeurotic fibres of the glutæus maximus and sacro-spinalis. The

other fleshy fibres of the latissimus dorsi come from the outer surface of the last three or four ribs by digitations, at first aponeurotic, which are laid the one over the other so as to present an imbricated appearance from above downwards, and which are interlaced with digitations of the obliquus externus abdominis, with which they form a pretty acute angle.

After thus commencing, the fibres of the muscle, which are so much the shorter and less oblique the higher they are, converge and proceed to the lower angle of the scapula, the upper fibres passing horizontally outwards, and those of the costal digitations ascending almost vertically. When arrived there, the muscle presents little breadth, but much thickness, and often receives a small fleshy bundle from the scapula. Then contracting considerably, it continues its progress upwards and outwards, applied upon the teres major, and is twisted upon itself, so as to be nearly covered in its turn by that muscle.

Lastly, arrived in the vicinity of the humerus, the fleshy fibres of the latissimus dorsi give rise to a tendon about three inches long and an inch broad. This tendon is turned from below upwards, and from behind forwards, over the lower edge of the teres major, whose direction it crosses a little. Its lower part receives the fleshy fibres of the upper part of the muscle, and its upper part those from below. At first contiguous with the tendon of the teres major, separated from it by cellular tissue and afterwards by a small synovial capsule, it soon unites with it to be inserted at the same time into the posterior lip of the bicipital groove. An aponeurotic band about two lines broad, descends from the small tuberosity of the humerus before these tendons, comes beneath them, and keeps them applied against the bone. The tendons themselves send out from their lower edge another fibrous expansion which throws itself into the brachial aponeurosis, and some bundles which line the bicipital groove in conjunction with the tendon of the pectoralis major.

885. The *posterior surface* of the body of this muscle is everywhere covered by the integuments, excepting at its upper and inner part where it is subjacent to the trapezius. The *anterior surface* covers the oblique muscles of the abdomen, the serratus posticus inferior, sacro-spinalis, levatores costarum, the inferior intercostal muscles, the serratus magnus, rhomboideus, teres major, infra-spinatus, the lower ribs and the inferior angle of the scapula.

886. The *anterior surface* of its tendon, united with that of the teres major, is in connection with the axillary vessels, the brachial plexus, and the coraco-brachialis. The *posterior* is contiguous with the upper and inner part of the humerus. A thin synovial capsule facilitates its motions upon that bone.

887. The latissimus dorsi carries the arm backwards by lowering it and making it turn upon its axis from without inwards. It applies the inferior angle of the scapula against the thorax, and brings the arm strongly against the walls of that cavity when it acts si-

multaneously with the pectoralis major. When it is suspended by the hands, and an effort is made to raise it, it pulls the trunk upon the arms. By taking its fixed point upon the humerus, it can also raise the ribs to which it is attached, and thus become a muscle of inspiration. Lastly, it is a tensor of the aponeurosis which covers the sacro-spinalis muscle, whose contractions it thus favours.

III.—MUSCLES OF THE HEAD.

A.—MUSCLES OF THE SKULL.

Of the Epicranial Aponeurosis.

888. This name is given to a broad fibrous expansion, adhering strongly to the integuments, and loosely attached to the pericranium by a lax cellular tissue which is destitute of adipose substance. It covers the whole upper part of the head. The fleshy fibres of the frontal, occipital and auricular muscles terminate in it. Its fibres, which are very distinct, white and parallel posteriorly, are in the rest of its extent greyish, interwoven and indistinct, in so much that it often appears to degenerate into cellular tissue. They are also frequently divided into bundles, and leave intervals of greater or less size between them.

1. *Epicranial Region.*

OF THE FRONTALIS.*

889. The *Frontalis* is a membranous muscle, of an irregularly quadrilateral form, covering the forehead, to the skin of which it strongly adheres. Its fibres, which are short and directed obliquely outwards toward the temple, become longer, parallel and straight in the middle, to be afterwards shortened more internally, where they are interwoven a little with those of the opposite side. Inferiorly they seem to unite with the pyramidalis nasi, palpebralis and corrugator supercilii. Its upper edge, which is continuous with the epicranial aponeurosis, describes, toward the fronto-parietal suture, a curve whose convexity is directed backwards, and is sometimes sinuous.

890. Its *anterior surface* is covered by the integuments; the *posterior* rests upon the os frontis, a little upon the temporal and superciliary muscles, and upon vessels and nerves which arise from the orbit to be distributed over the forehead.

891. It brings forwards part of the integuments of the head,

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* M. M. Boyer, Chaussier, Soemmering, and most anatomists confound this muscle with the following, under the general name of *Occipito-frontalis*, or *Epicranius*.

wrinkles the skin of the forehead transversely, and may contribute to open the eye by its union with the orbicularis palpebrarum.

OF THE OCCIPITALIS.

892. The *Occipitalis*, which resembles the preceding, but is a little less adherent to the skin, is narrower and more regularly quadrilateral. It is situated at the posterior part of the skull, behind the mastoid process and above the upper curved line of the occipital bone. It is attached by short aponeurotic fibres to the outer part of that line and to the neighbouring region of the temporal bone, above the splenius and sterno-cleido-mastoideus. Like the frontalis, it terminates in the epicranial aponeurosis. It is covered by the integuments and by some nervous filaments, and lies upon the occipital and temporal bones.

893. Its action is less marked than that of the frontalis. It pulls backward a part of the skin of the head, without wrinkling it much, and stretches the common aponeurosis.

2. *Auricular Region.*

OF THE ATTOLLENS AURICULAM.

(*Temporo-oriculaire*, Chauss.)

894. This muscle is situated on the temple, above the ear. It is thin and membranous, broad above, narrow below, and of a triangular form. It is attached by its summit to the fore and inner part of the fibro-cartilage of the ear, on the convexity which is formed by the upper part of the concha, and ascends from thence, in a radiating manner, and expanding its fibres, to the epicranial aponeurosis, where it terminates. It is entirely fleshy, excepting at its summit, where there are observed some fibrous parts.

895. Its *outer surface* is covered by the skin, while the *inner* covers the aponeurosis of the temporal muscle. Its *posterior edge* is very short and oblique. The *anterior* is confounded with the next muscle.

896. It raises the ear, and stretches the epicranial aponeurosis.

OF THE PRIOR AURICULÆ, AURICULARIS ANTICUS.

(*Zygomato-oriculaire*, Chauss.)

897. It is of the same form as the attollens auriculam, but less apparent, and is situated on the temple, before the ear. Its summit is attached to the fore part of the helix, and it is from this point that its fibres proceed, separating considerably from each

other, to terminate on the outside of the epicranial aponeurosis, near the frontal muscle.

898. Its *outer surface* is covered by the skin; the *inner* is applied upon the temporal muscle and artery. Its *upper edge* is confounded with the preceding muscle, while the *lower* is lost in the cellular tissue above the zygomatic arch.

899. It carries the ear forwards and upwards.

OF THE MUSCULI RETRAHENTES AURICULAM, AURICULARIS POSTICUS.

(*Mastoido-oriculaire*, Chauss.)

900. This muscle consists of one or more small bundles of fleshy fibres, thin, flat or fusiform, rather irregular, and situated behind the ear. They are attached by short aponeuroses to the mastoid process, whence they proceed horizontally forwards to terminate at the lower part of the convexity formed by the conch of the ear, by means of aponeurotic fibres or small tendons. They are covered by the integuments, and are separated from the temporal bone by cellular tissue.

901. This muscle, which has no connection with the epicranial aponeurosis, carries the ear backwards.

3. *Anterior Occipito-cervical Region.*

OF THE RECTUS CAPITIS ANTICUS MAJOR, OR TRACHELO-INFRA-OCCIPITALIS MAJOR.

902. This muscle, which is flat, elongated, and much broader and thicker above than below, lies upon the anterior and lateral part of the cervical column. Four small thin and flat tendons, fixed by a pointed extremity to the anterior tubercle of the sixth, fifth, fourth and third transverse processes of the neck, and so much the larger the higher they are, give origin to the fleshy fibres of this muscle, which are united into so many imbricated bundles, behind which they are more or less prolonged. To these bundles there is frequently joined another which comes from the longus colli. They all proceed from below upwards and from without inwards, becoming broader in their progress, and mingling together, to terminate, that of the fourth tendon at the basilar surface, near the occipital hole and that of the opposite side, the three first successively and in the order of their origin, at the posterior surface of a pretty strong, broad and thin aponeurosis, which is prolonged very low upon the anterior surface of the muscle, and comes from the basilar surface also, before the fleshy fibres arising from the last tendon.

903. Its *anterior surface* corresponds to the carotid artery, the internal jugular vein, the pneumo-gastric nerve, the superior cervi-

cal ganglion, and the pharynx. The *posterior surface* covers the longi colli and rectus capitis anticus minor, the articulations of the occipital bone with the atlas, and of the atlas with the axis, and the transverse processes of the cervical vertebræ. Its *inner edge* is united to the longus colli by cellular tissue. The *outer edge* is free above.

904. This muscle bends the head upon the neck, directly, if it acts in conjunction with that of the opposite side, and laterally, if it acts by itself. It seldom has any influence upon the motions of the vertebral column, which however is the case in jugglers who balance the body upon the head.

OF THE RECTUS CAPITIS ANTICUS MINOR, OR TRACHELO-INFRA-OCCIPITALIS MINOR.

905. It is situated behind the preceding muscle, and has nearly the same form, but is much shorter and narrower. It arises below, from the fore part of the lateral mass and of the transverse process of the atlas, by aponeurotic fibres which are prolonged to a considerable distance upon the fleshy fibres. From thence it ascends, becoming broader, to the anterior margin of the occipital hole and the cartilaginous substance which unites the petrous portion of the temporal bone with the basilar process. It terminates behind the rectus anticus major, and a little more externally, by thin aponeuroses. It is concealed by that muscle, and covers the atloido-occipital articulation. Its action is to bend the head slightly upon the neck.

4. *Posterior Occipito-cervical Region.*

OF THE RECTUS CAPITIS POSTICUS MAJOR.

(*Axoido-occipital*, Chauss.)

906. This muscle, which is elongated, flat, triangular, and much broader above than below, is situated behind the articulation of the head with the vertebral column. It is attached by short aponeuroses, above the obliquus capitis inferior, to the tubercle of the spinous process of the axis, whence it ascends outwards and a little backwards, to terminate in a radiating manner, under the inferior curved line of the occipital bone, between the rectus minor and obliquus superior.

907. Its *posterior surface* is covered by the complexus major and obliquus superior. The *anterior* corresponds to the occipital bone, the posterior arch of the atlas, the posterior atloido-axoidal ligament, the rectus minor muscle, and the vertebral artery.

908. It extends the head, directly when it acts in conjunction

with its fellow, obliquely when by itself, in which case it produces a motion of rotation by which the face is turned to the same side.

OF THE RECTUS CAPITIS POSTICUS MINOR.

(*M. Atloido-occipital,* Chauss.)

909. It is situated before the rectus posticus major, and has nearly the same form, but is shorter. It is attached to the tubercle of the posterior arch of the atlas by a short tendon with radiating fibres, from whence it proceeds nearly in a vertical direction, becoming broader toward the occipital bone, where it is inserted into the impressions observed near its crest, and above its lower curved line, not far from the occipital hole.

910. Its *posterior surface,* which is inclined downwards, is covered by the complexus magnus, from which it is however separated by much fat, and by the preceding muscle. The *anterior surface* covers the occipital bone, the posterior occipito-atloidal ligament, and the vertebral artery.

911. It inclines the head backward upon the atlas.

OF THE OBLIQUUS CAPITIS INFERIOR.

(*M. Axoido-atloidien,* Chauss.)

912. Elongated, rounded and fusiform, it is attached by indistinct aponeurotic fibres to the tubercle of the spinous process of the axis near the rectus major. It then proceeds backwards, outwards and upwards, and is inserted behind and beneath the summit of the transverse process of the atlas, by means of aponeurotic fibres which are also indistinct. Its *posterior surface* is covered by the complexus major and minor. The *anterior* is applied upon the lamina of the second vertebra, the posterior axoido-atloidal ligament, and the vertebral artery.

913. It impresses a rotatory motion upon the first vertebra, which turns the face toward its own side.

OF THE OBLIQUUS CAPITIS SUPERIOR.

(*M. Atloido-sous-mastoidien,* Chauss.)

914. It is situated on the sides and behind the articulation of the head, and is an elongated and flat muscle, narrower below than above. It arises by a sort of small tendon from the summit of the first transverse process of the neck, before the preceding, with which it is a little united. It then ascends backwards and inwards, becoming broader, and arrives beneath the outer part of the superior curved line of the occipital bone, and sometimes at the mastoid process of the temporal, where it is fixed between the splenius and rectus capitus posticus major, by pretty distinct aponeurotic fibres.

Its *posterior surface*, which is inclined downwards, is covered by the two complexi and by the splenius. The *anterior* passes over the occipital bone, the vertebral artery, and the attachment of the rectus capitis posticus major.

915. It extends the head, inclining it to its own side.

5. *Posterior Occipito-Cervical Region.*

OF THE RECTUS CAPITIS LATERALIS.

(*M. Atloido-sous-occipital*, Chauss.)

916. This muscle appears to be analogous to the intertransversales colli (833), and might even be considered as the first of them. It is thin and flat, and of an elongated square form. It is attached inferiorly, by a small tendon, to the upper and anterior parts of the transverse process of the atlas, whence it ascends vertically to the occipital bone, to terminate at an impression which that bone presents behind the jugular fossa. Its *anterior surface* is covered by the internal jugular vein, the *posterior* corresponds to the vertebral artery.

917. It inclines the head laterally and forwards.

B. MUSCLES OF THE FACE.

1. PALPEBRAL REGION.

OF THE ORBICULARIS PALPEBRARUM.

(*M. Naso-palpebral*, Chauss.)

918. The *Orbicularis palpebrarum* surrounds the base of the orbit, and occupies the greater part of the upper and lateral region of the face. It is broad, thin, and circular, and is slit transversely in the middle for the aperture of the eyelids. It has three distinct points of origin internally for its fleshy fibres. 1st, At the ascending processes of the upper maxillary bones and the internal orbitar process of the frontal; 2dly, at the anterior edge of the lachrymal groove and the neighbouring part of the base of the orbit; 3dly, at the two sides and fore part of a small tendon, about half a line broad, and two lines long, stronger toward its point of attachment than toward the place where it terminates, and proceeding transversely outwards, from the anterior edge of the lachrymal groove, to the internal commissure of the eyelids, where it bifurcates to be continued into each of the fibro-cartilages, situated in the substance. Posteriorly, this tendon adheres intimately to a thin aponeurosis, which covers the lachrymal sac, which also gives rise to some fleshy fibres, and which was formerly called the *reflected tendon of the orbicularis palpebrarum.*

After originating in this manner, the upper and lower fibres of the muscle proceed, in opposite directions, to the upper and under parts of the base of the orbit, and following its curvature, unite at the outside of the external commissure of the palpebræ. The middle fibres, which are less distinct, much less curved, and always very pale, are distributed into the substance of both eyelids, and also unite below the outer commissure by a tendinous line sometimes of considerable size. All these fibres describe concentric curves, of which the centre corresponds to the aperture of the eyelids, where they are much shorter. Those which are nearest the circumference are almost circular; the others describe a sort of ellipse, and the more central do not even go so far as the commissures of the palpebræ.

919. The *anterior surface* of this muscle is covered by the skin, to which it is intimately united above, while below it is separated by fat; and in the place which corresponds to the eyelids, it is in connection with a very delicate laminar tissue, which is constantly moistened with serum. The *posterior surface* is applied superiorly upon the corrugator supercilii, to which it adheres; lower down, upon the ligamentum latum and the fibro-cartilage of the upper eyelid; externally, upon the external orbitar process, and the aponeurosis of the temporal muscle; below, upon the cheek bone, the zygomatic muscles, the levator labii superioris, the levator labii superioris alæque nasi, from which it is separated by the facial vein, and upon the ligament of the fibro-cartilage of the lower eyelid; internally, upon the ascending process of the superior maxillary bone, and the lachrymal sac. Its *circumference* is confounded, above and below, with the pyramidalis nasi, then a little more outwards, with the anterior edge of the frontalis (889). At its lower part, it is free, and some irregular bundles of fibres are detached from it, which are lost in the cellular tissue of the cheek, and which describe curves whose convexity is below. Some of them unite with the zygomaticus minor.

920. The orbicularis palpebrarum carries the eyelids toward each other, bringing them over the fore part of the ball of the eye, upon which it is applied, wrinkling them more or less. It also depresses the eyebrow at the same time that it raises the cheek, and renders it more prominent. It determines the course of the tears toward the inner angle of the eye. The cessation of its action allows the eyelids to open. It is the antagonist of the levator palpebræ superioris.

OF THE CORRUGATOR SUPERCILII.

(*M. Fronto-sourcilier*, Chauss.)

921. The *Corrugator Supercilii* is a short and thin muscle, which describes the same curve as the superciliary arch of the frontal bone, on which it lies. Internally, it is attached toward the nasal prominence of the same bone by an extremity which is sometimes simple, but is most commonly divided into two or three portions. It terminates in a pointed form, about the middle of the orbitar arch, where it is confounded with the frontalis and orbicu-

laris palpebrarum. Its *anterior surface* is covered by these two muscles, and, a little inwards, by the pyramidalis nasi. The *posterior surface* covers the frontal bone, the superciliary artery, and the frontal branch of the ophthalmic nerve.

922. It draws toward the nose the skin of the eyebrows, of which it raises the hairs so as to shade the eye. It acts especially in the malevolent and depressing passions.

OF THE LEVATOR PALPEBRÆ SUPERIORIS.

(*M. Orbito-palpebral*, Chauss.)

923. This muscle, which is situated in the interior of the orbit, is long, slender, thin, and depressed, much broader anteriorly than posteriorly, and accompanies the rectus oculi superior. It is attached, by short aponeuroses, to the meningeal sheath of the optic nerve, and by a small tendon to the lower surface of the small wing of the sphenoid bone, not far from the optic foramen, from which it is only separated by the rectus superior. From these origins, it is directed horizontally forwards, until it arrives at the upper part of the ball of the eye, when it curves downwards, expanding and gradually losing its red colour, to descend as far as the fibro-cartilage of the upper eyelid, to the upper edge of which it is attached by a very thin and membranous aponeurosis, which sends some fibres to the outer part of the orbit, and which contributes to the formation of the palpebral ligament.

924. Its *upper surface* is in contact, posteriorly, with the vault of the orbit, and with the frontal branch of the ophthalmic nerve. More anteriorly, it is covered by much adipose cellular tissue; and at its foremost part, the palpebral ligament separates it from the orbicularis palpebrarum. Its *inferior surface* is in connection posteriorly with the rectus superior, and anteriorly with the tunica conjunctiva.

925. It raises the upper eyelid, and draws it backwards within the orbit.

2. *Ocular Region.*

OF THE ATTOLLENS OCULUM, OR RECTUS OCULI SUPERIOR.

926. It is situated under the levator palpebræ superioris, and has the same form as that muscle, but is a little shorter. It is attached, posteriorly, between it and the optic foramen, to the process of Ingrassias and the fibrous sheath of the optic nerve, mingling there a little with the abductor oculi. It then proceeds horizontally forwards to the upper part of the ball of the eye, where it degenerates into a thin aponeurosis, which transmits a part of its fibres to the sclerotic membrane.

927. This aponeurosis, as well as that which terminates toward the eye the three other recti, is separated from that organ by a

small indistinct synovial capsule, the walls of which are soft, and as it were downy.

928. Its *upper surface* is covered by the levator palpebræ superioris, from which it is separated by some nervous filaments and by the conjunctive membrane; the *inferior surface* rests, posteriorly, on the optic nerve, the ophthalmic artery, and the nasal branch of the ophthalmic nerve, and, anteriorly, upon the eye itself.

929. It raises the eye.

OF THE DEPRESSOR OCULI, OR RECTUS INFERIOR.

930. This muscle is of the same form as the preceding, and lies upon the floor of the orbit. It arises posteriorly from a tendon which is common to it with the internal and external recti, and proceeds horizontally towards the ball of the eye, on which it terminates in the same manner as the rectus superior and the two following muscles.

931. Its *inferior surface* is separated from the floor of the orbit by a quantity of adipose tissue, and is covered anteriorly by the conjunctiva. The *upper surface* is in connection with the optic nerve, a branch of the third pair of nerves, and the eye.

932. It is the antagonist of the attollens oculum, and draws the eye downwards.

OF THE ADDUCTOR OCULI; OR RECTUS INTERNUS.

933. It resembles the two preceding muscles and the abductor, and occupies the internal region of the orbit. Posteriorly, it is attached to the small tendon of which we have spoken, and a little to the margin of the optic hole, and proceeds horizontally forwards to the inner side of the eye. Its *internal surface* corresponds to the orbit; the *external* to the optic nerve.

934. It carries the eye inwards.

OF THE ABDUCTOR OCULI, OR RECTUS EXTERNUS.

935. It is situated at the outer side of the orbit, and arises from the tendon already mentioned, and from the outer part of the circumference of the optic hole, by short aponeuroses. Between these two origins pass the third pair of nerves, the sixth pair of nerves, and the nasal branch of the ophthalmic. The muscle then proceeds horizontally outwards and forwards, to the outer part of the eye. It corresponds by its *external surface* to the periosteum of the orbit and to the lachrymal gland; by its *internal surface* to the optic nerve and sixth pair, as well as to the lenticular ganglion.

936. Its action is to draw the eye outwards.

937. There results from the description of the four recti muscles

of the eye, that they have all nearly the same form, and agree in possessing the following characters in common; 1st, three of them, the inferior, the outer, and the inner, arise posteriorly from the same small tendon which is attached near the pituitary fossa at the inner extremity of the sphenoidal fissure, and which, after traversing the latter, divides into three portions, which are distributed one to each of them; 2dly, their fleshy fibres, which are at first parallel, are afterwards divergent; 3dly, once that they have passed the middle portion of the ball of the eye, they experience a manifest curvature; 4thly, they are close together at the bottom of the orbit, but separate anteriorly to embrace the ball of the eye; their broad and thin aponeuroses are partly confounded with the sclerotic membrane; 5thly, they are connected together by cellular tissue, which gives them the appearance of a conical bag around the eye.

938. Besides their position and their relations to the surrounding parts, the recti are distinguished from each other by various characters. The inferior and superior are flattened from above downwards; the external and internal laterally. The external and internal are shorter than the others. The upper is the thinnest, the inner the thickest. The outer, which is more curved than the rest, receives a pair of nerves for itself. The inner alone proceeds directly forward; the others are oblique, especially the outer

939. When these muscles act together, they draw the ball of the eye into the bottom of the orbit. By contracting successively in pairs, they impress upon it all the intermediate motions between those which we have already mentioned, and make it perform a sort of circumduction.

OF THE OBLIQUUS SUPERIOR OCULI, OR OBLIQUUS MAJOR.

940. The *obliquus superior* is a slender rounded, fusiform muscle, much longer than any of the preceding, but thinner and narrower. It is situated at the upper and inner part of the orbit, and is reflected upon itself, about the middle of its course. It arises behind, by short aponeuroses, and near the optic foramen, from the prolongation of the dura mater which lines the orbit. It is there confounded a little with the insertion of the levator palpebræ superioris. It then proceeds horizontally to the internal orbitar process, passing beneath the internal orbitar foramina. When arrived there, it degenerates into a slender and rounded tendon, surrounded by a kind of cellular sheath, which is soft and loose. It is engaged in a cartilaginous ring which converts into a canal the depression observed upon the frontal bone at this place, and of which the two extremities are attached to the bone in a moveable manner by very short fibrous ligaments. In the interior of this sort of pulley is a synovial capsule which is reflected over the tendon and accompanies it for some time, forming around it a

very distinct and close sheath; the tendon is curved from above downwards and from within outwards at a right angle. It then proceeds backwards and downwards between the rectus superior and the ball of the eye, and is converted into a radiated aponeurosis which continues to descend over the outer and posterior part of the ball of the eye, where it terminates, near the entrance of the optic nerve, confounding a portion of its fibres with the sclerotic membrane.

941. This muscle is placed between the orbit, the optic nerve, the superior and internal recti muscles, and the ball of the eye.

942. It carries the ball of the eye forwards and inwards, making it experience a rotatory motion which directs the pupil downwards and inwards.

OF THE OBLIQUUS INFERIOR OCULI, OR OBLIQUUS MINOR.

943. The *obliquus inferior* which is situated at the anterior and under part of the orbit, is smaller and less rounded than the preceding muscle. It is attached to the inner and fore part of the orbit or surface of the superior maxillary bone, a little to the outside of the lachrymal groove, whence it is directed backwards and outwards, curving upwards upon the convexity of the eye between it and the rectus externus. It then degenerates into an aponeurosis which terminates in the sclerotic membrane, at the distance of two lines from the entrance of the optic nerve.

944. Its *inferior surface* rests upon the floor of the orbit; the *upper* corresponds to the ball of the eye and to the rectus inferior.

945. It carries the ball of the eye inwards and forwards, and directs the pupil upwards and outwards. When it acts along with the preceding muscle, the eye is carried forwards and inwards, which counterbalances the effort made by the united recti muscles.

3. *Nasal Region.*

OF THE PYRAMIDALIS NASI.

(*M. Fronto-nasal*, Chauss.)

946. This muscle, which many anatomists regard as an appendage of the frontalis, with whose fibres it is interlaced at its upper part, covers the nasal bones. The two pyramidal muscles are united above, and only separate towards the middle of the nasal bones, to terminate in a diverging manner, in a membranous tissue rather cellular than fibrous, which occupies the sides of the nose, and also receives the fibres of the triangularis nasi. Each of

them is constituted by a slender and triangular fasciculus which is confounded externally with the orbicularis palpebrarum.

947. The *anterior surface* of the pyramidalis nasi is covered by the skin; the *posterior* is applied upon the corrugator supercilii, the frontal bone, the fronto-nasal suture, and the ossa nasi.

948. It contributes very little to the motions of the nose, and can only serve to give the frontalis muscle a fixed point at the moment when it brings forward the integuments of the skull.

OF THE COMPRESSOR, OR TRIANGULARIS.

(*M. Sus-maxillo-nasal*, Chauss.)

949. This muscle is thin, flat and triangular, and is situated upon the sides of the nose. It arises internally of the fossa canina by a very short and narrow aponeurosis, from which proceed in a divergent manner, the fleshy fibres, which issuing from beneath the levator labii superioris alæque nasi, cover the back of the nose, describing a curve whose convexity is directed upwards. The superior fibres which are longer, ascend, and the inferior, which are shorter, are horizontal. They gradually degenerate into a rather loose aponeurotic expansion, which covers the nose, adheres to it, and is continuous with the pyramidalis nasi and the compressor of the opposite side. One of its portions is attached to the fibro-cartilage of the wing of the nose.

950. Its *anterior surface* is covered by the skin, and a little by the levator communis muscle; the *posterior* is applied upon the superior maxillary bone, and upon the lateral cartilage of the nose.

951. Anatomists have attributed entirely opposite uses to this muscle. Its true action is to draw the wings of the nose outwards, and thus to dilate the nostrils.

OF THE LEVATOR LABII SUPERIORIS ALÆQUE NASI.

952. This muscle is a thin triangular fleshy bundle, contracted at its upper part, and broader below. It is situated on the sides of the nose. It arises above from the outer surface of the ascending process of the superior maxillary bone, beneath the tendon of the orbicularis palpebrarum, as well as from the anterior edge of the lachrymal groove and the lower part of the base of the orbit, by short aponeuroses, to which succeed the fleshy fibres, which descend obliquely outwards in a diverging manner, and are partly attached to the fibrous membrane, the fibro-cartilage, and even the skin of the wing of the nose, and partly lose themselves in the upper lip, passing before the orbicularis oris.

953. Its *anterior surface* is placed beneath the skin, to which

it adheres intimately below. At its upper part alone, it is concealed by a portion of the orbicularis palpebrarum and by the labial vein. The *posterior surface* covers the preceding muscle, the ascending process of the superior maxillary bone, the edge of the levator labii superioris, the depressor alæ nasi, a part of the orbicularis oris, and some branches of the infra-orbitar nerve.

954. It raises the upper lip and the wing of the nose, which it also draws a little outwards.

OF THE DEPRESSOR ALÆ NASI.

955. This is a small fleshy bundle, somewhat irregular, placed beneath the wing of the nose and behind the upper lip. It arises, by short aponeuroses, near the anterior nasal spine, from a small fossa, whence it ascends in part toward the posterior region of the wing of the nose, and is partly confounded with the levator labii superioris alæque nasi and the orbicularis oris. Internally, its fibres are vertical, externally oblique. They are covered by those of the levator labii superioris alæque nasi, and by the mucous membrane of the mouth, and are applied upon the superior maxillary bone.

956. It depresses the wing of the nose.

3. *Superior Maxillary Region.*

OF THE LEVATOR LABII SUPERIORIS.

957. This muscle is thin, flat, rather short, and of a very irregularly quadrilateral form. It is situated at the middle and inner part of the face, beneath the edge of the orbit. It is attached above the infra-orbitar foramen, over an extent of about an inch, to the malar and upper maxillary bones, by short aponeurotic fibres, pretty frequently divided into two and sometimes into three fasciculi. From thence it descends, contracting, downwards and inwards, to the corresponding lip, where it is confounded with the orbicularis oris, between the nose and the commissure.

958. Its *anterior surface* is covered at its upper part by the orbicularis palpebrarum and labial vein, and below by the skin, to which it strongly adheres. The *posterior surface* is in connection with the levator anguli oris, from which it is separated by the infra-orbitar vessels and nerve, as well as by a great quantity of adipose tissue. It also covers the depressor alæ nasi. Its *inner edge* is often confounded with the levator labii superioris alæque nasi; and the *outer* is more frequently united to the zygomaticus minor.

959. It raises the upper lip, carrying it a little outwards.

OF THE LEVATOR ANGULI ORIS.

960. This is a small elongated flat muscle, broader and thinner above than below, attached, beneath the infra-orbitar hole, by short aponeuroses, to the fossa canina, from which it descends obliquely outwards to the commissure of the lips, where it seems to be continuous with the triangularis, although some of its fibres are interlaced with those of the orbicularis oris, zygomaticus major, and buccinator muscles.

961. Its *anterior surface* is covered above by the preceding muscle, and the infra-orbitar vessels and nerves, and below by the zygomaticus minor and the skin. The *posterior surface* covers the fossa canina, the mucous membrane of the mouth, and the buccinator.

962. It raises the commissure of the lips and carries it inwards.

OF THE ZYGOMATICUS MAJOR.

963. This muscle is situated obliquely at the fore part and on the sides of the face. It is elongated, slender, and rounded, and is inserted by aponeuroses, below the outer surface of the malar bone, near its posterior angle; whence, becoming a little broader, it descends inwards and forwards, and terminates at the commissure of the lips, where it is continuous with the levator anguli oris, triangularis, buccinator and orbicularis, sometimes bifurcating.

964. Its *anterior surface* is concealed above by the orbicularis palpebrarum and farther down by the skin, from which it is often separated by an enormous quantity of fat. The *posterior surface* covers the malar bone, the masseter and buccinator muscles, the labial vein, and a more or less considerable mass of adipose tissue.

965. It raises the commissure of the lips, which it carries backwards and outwards. It acts principally in laughing.

OF THE ZYGOMATICUS MINOR.

966. This muscle does not occur in all subjects. It is situated internally of the preceding and above it, and is flat, elongated, and very thin. It arises from the outer surface of the malar bone, and sometimes even seems to be detached from the orbicularis palpebrarum, and descends more or less obliquely inwards, terminating in the levator labii superioris, or in the orbicularis oris.

967. Its *anterior surface* is covered by the skin and orbicularis palpebrarum. The *posterior* covers the malar bone, the levator anguli oris, and the labial vein.

968. It raises the upper lip and draws it outwards.

5. *Inferior Maxillary Region.*

OF THE DEPRESSOR ANGULI ORIS, OR TRIANGULARIS LABIORUM.

(*M. Maxillo-labial,* Chauss.)

969. This muscle, which is thin, flat, and triangular, is situated at the lower part of the face, arising from the external maxillary line, between the masseter muscle and the mental hole, by short aponeurotic fibres, succeeded by fleshy fibres, of which some appear to come from the platysma myoides. These fibres ascend toward the commissure of the lips, those in the middle vertically, the anterior obliquely backwards, and the posterior from behind forwards. At the summit of the muscle, they are confounded with the zygomaticus major and orbicularis oris, but more especially with the levator anguli oris.

970. The *outer surface* adheres strongly to the skin. The *inner* covers the platysma myoides, buccinator and depressor labii inferioris, to which latter it is united.

971. It lowers the commissure of the lips, and acts especially in grief.

OF THE DEPRESSOR LABII INFERIORIS, QUADRATUS GENÆ.

(*M. Mento-labial,* Chauss.)

972. It is situated to the inside of the preceding muscle, and is thin and quadrilateral. It arises from the external oblique line of the inferior maxillary bone, and ascends in the lower lip, where it is confounded with the orbicularis oris. Its fibres, which are parallel, and seem to be continuous with those of the platysma myoides, are directed obliquely upwards and inwards, uniting in the most intimate manner internally and above with those of the opposite side, and internally and below with those of the levator menti, while externally and below they are interlaced with those of the preceding muscle.

973. Its *anterior surface* is covered by the depressor labii inferioris and by the skin, to which it strongly adheres. The *posterior surface* is applied upon the lower jaw, the mental nerve and vessels, and the orbicularis oris and levator menti.

974. This muscle depresses the lower lip.

OF THE LEVATOR MENTI,* OR LEVATOR LABII INFERIORIS.

975. This muscle is situated between the two depressores labii inferioris. It is short, thick, and conical. It is attached by its

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* M. Chaussier considers it as a portion of his *mento-labial.*

summit to the fossa which is observed on the side of the symphysis of the chin, under the alveoli of the incisors, where it presents a small tendon. Its fibres diverge from this point, and are inserted into the skin of the chin, to which they strongly adhere, and where they produce the small hollows that are generally observed on that part.

976. It is covered *above* by the mucous membrane of the mouth; *internally* it is separated from that of the opposite side by cellular tissue; *externally*, it is contiguous with the depressor labii inferioris and orbicularis oris; *below*, it lies upon the jaw, and is covered *anteriorly* by the integuments.

977. It raises the chin, and pushes the under lip a little upwards. Its upper fibres also serve to invert the lip.

6. *Inter-maxillary Region.*

OF THE BUCCINATOR.

(*M. Alveolo-labial*, Chauss.)

978. The *Buccinator*, of which the cheek is especially formed, is much larger in glass-blowers and persons who play habitually on wind instruments than in other individuals. It is flat, thin, and quadrilateral, and is situated in the interval between the two alveolar borders. It is attached above to the posterior part of the upper alveolar border, from the last tooth to the second small grinder; below, to the same part of the lower alveolar border; in the middle, to an aponeurosis which descends from the summit of the inner wing of the pterygoid process, and which receives on the other side fibres from the constrictor pharyngis superior. From these different origins the fleshy fibres proceed toward the commissure of the lips, but following different directions, the upper descending, the lower ascending a little, and the middle fibres passing horizontally forwards. They all meet at the commissure, where a marked interlacing takes place between the upper and lower, the former passing into the under lip, the latter into the upper, where they are confounded with the fibres of the orbicularis oris.

979. This muscle is covered by an extremely thick layer of fat, without which the cheek would appear hollow, and which even forms in the middle of the latter a sort of ball, appearing as if separated from the neighbouring parts. By this fat, its *external surface* is separated posteriorly from the coronoid process, and from the lower part of the temporal muscle; and in the middle, from the masseter. Anteriorly, it is covered by the zygomaticus major, platysma myoides, and triangularis muscles, by the skin, by the labial artery and vein. A kind of whitish membrane, formed of a fibrous cellular tissue, also covers it in its whole extent, adhering intimately to it, and prevents posteriorly the buccal glands from being immediately applied upon it. The *inner surface* is lined by the mucous membrane of the mouth. Opposite the third molar

tooth, it is obliquely traversed by the excretory duct of the parotid gland.

980. It draws the commissure of the lips backwards, and contributes to mastication, by keeping the food between the teeth. If the mouth is filled with air which distends the cheeks, it compresses it and drives it out, as in the action of blowing, sounding a trumpet, &c.

OF THE ORBICULARIS ORIS.

(*M. Labial*, Chauss.)

981. This muscle is formed by fibres which exist in the substance of either lip, and by the terminations of the zygomatici, levatores labii, levatores anguli oris, depressores labii inferioris, levatores menti and buccinators, which are interlaced in a very complicated manner, and are confounded with its proper fibres. These latter correspond to the free edge of the lips. They are concentric, curved, and divided into two planes, of which one belongs to the upper, the other to the under lip. Viewed in connection, they present an oval form, and intersect each other at their two commissures.

982. This muscle is covered *anteriorly* by the skin, to which it firmly adheres. The *posterior surface* is lined by the mucous membrane of the mouth, to which it is more loosely attached. It is also in connection with the labial glands. Its *free circumference* is invested by the red membrane of the lips. Its *great circumference* is continuous on all sides with the muscles which we have just enumerated. Superiorly and in the middle, it is attached by some fibres to the lower part of the septum of the nose.

983. This muscle brings the lips toward each other, and contracts the aperture of the mouth, which it carries forward, making it represent a sort of rim with radiating wrinkles. It acts in suction, in playing upon musical instruments, &c. It also acts as an antagonist to all the other muscles of the lips.

7. *Pterygo-maxillary Region.*

OF THE PTERYGOIDEUS INTERNUS.

(*M. Grand pterygo-maxillaire*, Chauss.)

984. This is a strong and thick muscle, representing a sort of a somewhat elongated parallelopiped, and situated internally of and a little behind the branch of the inferior maxillary bone. It arises from the whole pterygoid fossa, and particularly from the inner surface of the outer wing of the pterygoid fossa, by very distinct aponeurotic fibres, which partly pass in the form of pretty strong fasciculi among the fleshy fibres, and are partly applied over the inner surface of the muscle. It descends backwards and outwards,

after receiving fibres from the middle groove of the upper surface of the palatal tuberosity, and some others from the outside of the summit of the outer wing of the pterygoid process. It then becomes thinner, and terminates internally of the angle of the jaw by aponeuroses equally long and distinct with those of its origin, which form more or less prominent ridges that are observed in this place, and are interposed between the fleshy fibres as above. From this disposition the fleshy and tendinous fibres are in nearly equal quantity in the internal pterygoid muscle.

985. Its *inner surface* covers, at its upper part, the circumflexus palati and constrictor pharyngis superior, and inferiorly the sub-maxillary gland. The *outer surface* lies internally upon the branch of the lower jaw, much in the same manner as the masseter does externally. It is separated from that bone above by an interval, in which are found the lingual and dentar nerves, the inferior dentar artery, and the internal lateral ligament of the temporo-maxillary articulation. (614.)

986. When the two muscles act simultaneously, the jaw is raised and carried a little forwards. If one only contracts, it carries it a little obliquely toward the opposite side. When the lower jaw is fixed, they depress the upper.

OF THE PTERYGOIDEUS EXTERNUS.

(*M. Petit pterygo-maxillaire*, Chauss.)

987. This muscle, which is of a conical form, or rather tetrahedral and short, is situated in the zygomatic fossa. It has two origins, one from the outer surface of the pterygoid process and from the palatal tuberosity, the other from the zygomato-temporal surface of the sphenoid bone (122), immediately beneath the upper edge of the spheno-maxillary fissure. These attachments are formed by aponeuroses, which advance as far as the middle front of the muscle. The internal maxillary artery often passes between them, in an interval filled with cellular tissue. From thence the muscle is directed outwards and backwards, becoming gradually thinner, and is inserted into a small fossa at the anterior surface of the neck of the condyle of the jaw and into the fore part of the circumference of the inter-articular fibro-cartilage (617.)

988. Its *outer surface* is in contact with the temporal muscle, and most commonly with the internal maxillary artery. The *inner surface* corresponds to the pterygoideus internus, the inferior maxillary nerve, the middle meningeal artery, and sometimes the internal maxillary artery. The *upper surface* touches the upper part of the zygomatic fossa, and the deep temporal and masseteric nerves.

989. The outer pterygoid muscle draws forward the condyle of the jaw and the fibro-cartilage of the articulation, moving the chin in the opposite direction. When the two act together, the jaw is drawn directly forwards.

Temporo-Maxillary Region.

OF THE MASSETER.*

(*M. Zygomato-maxillaire*, Chauss.)

990. The *Masseter* is of nearly the same form as the internal pterygoid muscle, and lies upon the outer surface of the lower jaw. It arises from the two anterior and outer thirds of the inferior edge of the zygomatic arch, from the inner surface of the arch, and at the same time a little from the internal aponeurosis of the temporal muscle. These three origins take place in a distinct manner; the first, by a very strong, broad, and thick aponeurosis, which covers the outer surface of the muscle to beyond its middle part, and is divided into several digitations which are interposed between its fleshy fibres; the second, by small aponeurotic bundles, which are much shorter; the third by small fibrous planes of still less extent. The fleshy fibres which come from these three points follow different directions. The first, which constitute the principal part of the muscle, pass obliquely downwards and backwards, to be inserted at the outside of the angle of the lower jaw, by small aponeurotic laminæ; the second descend vertically and are attached a little higher; the third proceed obliquely downwards and forwards to terminate behind the coronoid process by other aponeuroses.

991. The *external surface* of this muscle is covered posteriorly by the parotid gland; below, by the platysma myoides; in the middle by Steno's duct, the facial nerve, and the transverse facial artery; anteriorly and above, by the orbicularis palpebrarum and zygomaticus major. All the other parts of this surface are in contact with the skin. The *internal surface* covers the ramus of the jaw, the tendon of the temporal muscle, and the buccinator, from which it is separated by a great quantity of fat.

992. The masseter raises the lower jaw, and acts much during mastication.

OF THE TEMPORAL MUSCLE, TEMPORALIS.

(*M. Temporo-maxillaire*, Chauss.)

993. The *Temporalis* is a broad triangular muscle, thin above, narrow and thick below, which fills the whole temporal fossa. It is inclosed, as it were, in a sort of sheath, formed internally by several of the bones of the skull, and externally by an aponeurosis, which is attached to the whole of the curved line of the temporal bone, to the posterior and superior edge of the malar bone, and to the upper edge of the zygomatic arch. This aponeurosis is of a violet tint above, where it is membranaceous, and pearly white be-

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* Μασαομαι, *comedo.*

low where it is thick and covered by a large quantity of fibrous cellular tissue, to which it intimately adheres. It is even there divided into two laminæ which contain in their interval a certain quantity of fat. The fleshy fibres take their origin from the whole extent of its inner surface, and from the periosteum of the temporal fossa, as well as from the small ridge which separates the latter from the zygomatic fossa. They all proceed obliquely over the two surfaces of another aponeurosis occupying the middle of the muscle, broad, radiated and triangular like it, and becoming gradually thicker as it descends. From its position, it separates the fleshy fibres into two planes, an outer and an inner, the former rather thin, the latter much thicker. Opposite the zygomatic arch, it separates from the fleshy fibres, and is converted into a very strong tendon, which descends vertically towards the coronoid process of the inferior maxillary bone, which it embraces in its whole extent, excepting at the outside, where the masseter is inserted.

994. The *external surface* of the temporal muscle is covered by the epicranial aponeurosis, the superior and anterior auricular muscles, the orbicularis palpebrarum and masseter, the superficial temporal vessels and nerves, and the zygomatic arch. The *internal surface* is applied upon all the bones which form the temporal fossa, the internal maxillary artery, the pterygoideus externus and buccinator muscles, from which it is separated by much fat. The *upper edge* of this muscle is curved; the *anterior* extends from the external orbitar process of the frontal bone to the anterior edge of the coronoid process of the lower jaw. The *posterior edge*, which is at first attached to the horizontal root of the zygomatic process, is reflected from above downwards over the base of that process, to proceed to the posterior edge of the coronoid process.

995. The temporal muscle strongly raises the lower jaw, lowers the upper a little, and presses the teeth against each other. The posterior portion draws the jaw backwards, when it has been carried forward by the action of the external pterygoid muscles.

9. *Lingual Region.*

OF THE HYO-GLOSSUS.

996. The *hyo-glossus* is a thin, broad, quadrilateral muscle, situated at the upper and fore part of the neck. It arises from three different points of the os hyoides, on which account it has been described by Albinus as consisting of three different muscles. The first, or *Cerato-glossus*, is attached by short aponeurotic fibres to the upper surface of the great horn of the hyoid bone. It ascends a little obliquely from behind forwards, contracting in its progress,

toward the lower and lateral part of the tongue, where it is continuous with a portion of the fibres of the stylo-glossus, after having passed between its two bundles, and finally terminates in the dermis of the mucous membrane. The second portion, or *Basio-glossus*, which is not so broad, but thicker, covers the preceding portion a little at its upper part, and is separated from it below by the lingual artery. It arises from the upper part of the anterior surface of the body of the hyoid bone, and descends a little obliquely backwards and outwards. Lastly, the third portion, or *Chondro-glossus* originates from the small horn of the same bone, as well as from the cartilage placed between the body and the large horn, and ascends upon the sides of the root of the tongue, where it is confounded, like the basio-glossus, with the lingualis and genio-glossus without its being capable of being traced to the tegumentary membrane.

997. The *outer surface* of this muscle is covered above by the stylo-glossus, with which it is connected; a little farther down, by the mylo-hyoideus, the great hypo-glossal nerve and the submaxillary gland; and still farther down, by the genio-hyoideus, stylo-hyoideus and digastricus. The *inner surface* is in connection with the constrictor pharyngis medius and genio-glossus muscles, the lingual artery, and the glosso-pharyngeal nerve.

998. The hyo-glossus lowers the base of the tongue, or raises the hyoid bone when the tongue is fixed. When it acts on one side only, it inclines the tongue towards the same side.

OF THE GENIO-GLOSSUS.

999. The *Genio-glossus* is a triangular radiated muscle, transversely flattened, and situated between the tongue and the lower maxillary bone. It arises from the upper tubercle of the genial process, by a small but very strong short tendon, which is more prolonged externally than internally, and from which proceed the fleshy fibres, diverging and following different directions, but almost always perpendicularly to the axis of the tongue. The upper fibres, which are the shortest, are at first horizontal, but on arriving at the lower part of the tongue, curve upwards and forwards to reach its point. The middle fibres, which are less curved, are confounded on the side with the lingual muscle. The inferior are much longer, and descend obliquely backwards to lose themselves at the base of the tongue, or even to be attached in part to the summit of the small horn of the os hyoides, or to be continued into the constrictor pharyngis medius. There results from this arrangement that the muscle represents a triangle whose base is attached to the tongue, where its fibres are interlaced with those of the lingualis, stylo-glossus, constrictor pharyngis superior, constrictor medius, and hyo-glossus. At the place where the two genio-glossi touch each other behind, there is observed a small bundle of fibres,

which ascend towards the middle ligament of the epiglottis, to be inserted at the dorsal surface of that organ.

1000. The *external surface* of the genio-glossus is covered by the sublingual gland, and the stylo-glossus, hyo-glossus, lingualis and mylo-hyoideus muscles. Its *inner surface* is in contact with that of the opposite side, and is even confounded with it below and behind. Its *lower edge* corresponds to the genio-hyoideus; the *upper*, to the mucous membrane of the mouth.

1001. The contraction of the inferior fibres of this muscle carries the tongue and hyoid bone forwards, after having previously raised the latter. The superior fibres pull it backwards, and restore it to its natural position; while the middle fibres hollow its dorsal surface into a groove.

OF THE STYLO-GLOSSUS.

1002. The *Stylo-glossus* is narrow above, broad and thin below, and arises chiefly from the stylo-maxillary ligament, which seems peculiarly intended for it. It is in fact attached to nearly the whole anterior edge of that ligament and to the lower half of the styloid process, by a thin aponeurosis. It there expands, and descends forwards and inwards, to be partly lost upon the edge of the tongue, and to be partly continued into the lingualis, hyo-glossus and genio-glossus muscles, after being divided into two and sometimes into three bundles.

1003. Its *outer surface* is covered by the digastric muscle, the lingual nerve, the submaxillary gland, and the mucous membrane of the mouth. The *inner surface* covers posteriorly the constrictor pharyngis superior, hyo-glossus and lingualis.

1004. The stylo-glossus carries the tongue upwards, backwards, and to a side, when it acts alone; but when it contracts at the same time with the other, the tongue is carried directly upwards and backwards.

OF THE LINGUALIS.

1005. The *Lingualis* is a small irregular bundle, entirely composed of fleshy fibres, lying under the sides of the tongue, between the hyo-glossus and stylo-glossus, which are on the outside, and the genio-glossus, which is within. It is elongated, thicker posteriorly than anteriorly, and is confounded in its lateral parts with the muscles just mentioned. Its posterior extremity loses itself in the base of the tongue; the anterior is prolonged as far as the tip of that organ. Its *inferior surface* is lined anteriorly by the mucous membrane of the mouth. The *upper* is confounded with the fleshy and ravelled texture of the tongue.

1006. It shortens the tongue and depresses its point.

10. *Palatal Region.*

OF THE CIRCUMFLEXUS PALATI, PERISTAPHYLINUS EXTERNUS, OR PTERYGO-STAPHYLINUS.*

1007. The *Circumflexus Palati* is found in the substance of the velum of the palate, and forms an elongated, thin, transversely flattened muscle, bent in the middle. It arises, by very distinct aponeurotic fibres, from the scaphoidal fossa of the pterygoid process (114), the fore and outer part of the fibro-cartilage of the Eustachian tube, and the parts in the neighbourhood of the great wing of the sphenoid bone, as far as the spine of that bone. From these origins it descends vertically along the posterior edge of the inner wing of the pterygoid process, and turns under the hook by which it terminates, after having degenerated into an aponeurosis which is wrinkled upon itself at the moment of this reflexion, and which is kept in place by a small ligament. A small synovial capsule facilitates its motions. After this, it proceeds horizontally inwards, is expanded in the velum palati, before the levator palati mollis, unites with its fellow, and terminates at the transverse ridge, which is observed upon the inferior surface of the horizontal portion of the palate bone (252). There it sends off a prolongation to a dense and compact membrane which seems to keep the velum palati firm at its upper part.

1008. The fleshy portion of this muscle which is fusiform, is covered, in its *external surface*, by the pterygoideus internus. By its *inner surface*, it is applied against the levator palati mollis and constrictor pharyngis superior, and against the inner wing of the pterygoid process. Its aponeurotic portion is lined internally by the mucous membrane of the velum palati. Posteriorly, it is connected with the palato-pharyngeus.

1009. This muscle stretches the velum palati horizontally, and may dilate the Eustachian tube as Haller supposes.

OF THE LEVATOR PALATI MOLLIS, PERISTAPHYLINUS INTERNUS, OR PETRO-STAPHYLINUS.

1010. Although this muscle is slender, it is yet stronger than the preceding, and is of an elongated form, round above, broader and flat below. It is situated on the sides of the posterior apertures of the nasal fossæ. It arises by short aponeuroses, from the under surface of the petrous process, before the external orifice of the carotid canal (177), and from the neighbouring part of the Eustachian tube. From thence it descends somewhat obliquely backwards and inwards, becomes broader, and terminates at the middle part of the velum palati, becoming confounded with that of the opposite side, the palato-staphylinus, and a little with the palato-pharyngeus and the aponeurosis of the circumflexus palati.

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* Περὶ, *circà, propè*; Σταφυλή, *uvula.*

1011. Its *outer surface* corresponds above to the circumflexus palati, and below to the palato-pharyngeus and constrictor pharyngis superior. The *inner* is lined above by the mucous membrane of the pharynx, and below by that of the velum palati.

1012. It raises the velum palati so as to apply it against the posterior apertures of the nasal fossæ.

OF THE LEVATOR UVULÆ, OR PALATO-STAPHYLINUS.

1013. This is a small elongated fusiform fleshy bundle, which occupies the substance of the uvula, and which is sometimes single, although in most cases it is distinct on both sides. It arises from the guttural spine and the aponeurosis common to the two circumflex muscles, and descends vertically to the tip of the uvula. It is connected anteriorly with the levator palati mollis, and is lined posteriorly by the membrane of the velum palati. It raises and shortens the uvula.

OF THE PALATO-PHARYNGÆUS, OR PHARYNGO-STAPHYLINUS.*

1014. This is a membranous muscle, broader at its extremities than at its middle part, vertically placed in the lateral wall of the pharynx and in the velum palati. From its origins being very distinct from each other, it may be divided into three portions, which Winslow has described as so many separate muscles. The first or upper, the *Peristaphylo-pharyngæus*, is attached to the posterior edge of the palatal vault, and to the aponeurosis of the circumflexus palati, confounding itself in the middle with that of the opposite side. It is broad and thin, and descends posteriorly in the velum palati. The second or middle portion, or *Pharyngo-staphylinus*, occupies the posterior pillar of the velum palati, and seems by its union with that of the opposite side and with the aponeurosis of the circumflexus palati, to form a sort of arch above the tonsils. It is very narrow. Both are continuous inferiorly with the third or lower portion, the *Thyro-staphylinus*, which is laterally flattened, while the others were so from before backwards, and which descends vertically on the side of the pharynx, sending some fibres to the thyroid cartilage, and intermingling with the stylo-pharyngæus and the lower and middle constrictor of the pharynx. It is broader than the middle portion.

1015. The *posterior surface* of this muscle is covered by the membrane of the velum palati and by the levator palati mollis above; by the constrictor of the pharynx below. The *anterior surface* is in contact with the aponeurosis of the circumflexus palati above, and with the mucous membrane of the pharynx below.

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* M. Chaussier has made it a portion of his stylo-pharyngæus.

1016. When the two muscles act together, they lower the velum palati, while at the same time they raise and shorten the pharynx. It is in deglutition that it principally acts.

OF THE CONSTRICTOR ISTHMI FAUCIUM, OR GLOSSO-STAPHYLINUS.

1017. This is a kind of small fleshy cord, very thin, somewhat flattened, and pretty regular, which is situated in the anterior pillar of the velum palati, between the membrane of the palate and the constrictor pharyngis superior, before the tonsil. Its lower extremity loses itself in the base of the tongue. The upper, which is narrower, is confounded, in the velum palati, with the palato-pharyngeus and circumflexus palati. This muscle lowers the velum palati and raises the base of the tongue.

IV. MUSCLES OF THE NECK.

1. *Anterior Cervical Region.*

OF THE LATISSIMUS COLLI, OR PLATYSMA MYOIDES.

(*M. Thoraco-facial*, Chauss.)

1018. This muscle has the appearance of a very thin fleshy membrane extended over the fore part of the neck, from the upper part of the thorax to the lower part of the face. It is of a quadrilateral form, broader above and below than in the middle. Its fibres originate in the adipose tissue which covers the upper part of the deltoides and pectoralis major, and sometimes even so far down as the fourth rib. From being at first scattered, they are brought nearer each other, and ascend obliquely inwards, the plane which they form on the sides of the neck assuming some degree of thickness. The two muscles thus converge toward each other. At the middle of the base of the jaw, they expand a second time. Their more anterior fibres, which are the longest and largest, intermingle beneath the symphysis of the chin, and terminate in the skin of that part. The middle fibres are fixed to the external oblique line of the lower jaw, and to the base of that bone. Several of them pass across those of the depressor anguli oris to be continued into the quadratus genæ, or ascend to the commissure of the lips. The posterior are in part confounded with the depressor anguli oris, and are in part lost in the cellular tissue of the cheek.

The latter sometimes ascend to the orbicularis palpebrarum, or direct themselves toward the ear, covering the trapezius a little; but the last of them, which are much shorter than the rest, do not reach so far as the jaw-bone. They are also frequently strengthened by a thin muscular plane, constituting the *Musculus risorius* of Santorini, which, arising before the parotid gland, or the aponeurosis of the masseter muscle, proceeds horizontally toward the angle of the mouth.

1019. The *external surface* of the latissimus colli is covered by the skin, from which it is separated by a dense cellular tissue, containing in general little fat. The *inner surface* covers at its lower part the deltoides and pectoralis major, as well as the clavicle; in the middle, the sterno-cleido-mastoideus, omo-hyoideus, sterno-hyoideus, sterno-thyroideus, thyro-hyoideus, digastricus and mylo-hyoideus, the external jugular vein, the carotid and superior thyroid arteries, and the maxillary gland. At the upper part, it lies upon the body of the lower jaw, part of the parotid gland, the masseter, buccinator, depressor anguli oris, levator menti, and zygomaticus major muscles, and the labial artery.

1020. It depresses and carries outwards the commissure of the lips; lowers the skin of the cheek and that of the neck, which it wrinkles transversely; assists in lowering the under jaw; and may also raise the skin which covers the upper part of the chest.

OF THE STERNO-CLEIDO-MASTOIDEUS, OR STERNO-MASTOIDEUS.

1021. This muscle is long, flat, about two inches broad, narrower in the middle than at its extremities, bifurcated below, and situated obliquely upon the anterior and lateral parts of the neck. The two branches of its bifurcation are separated from each other by an interval filled with cellular tissue. The inner or anterior, which is thicker and narrower than the other, arises from the fore part of the upper extremity of the sternum, by a tendon which ascends very high upon the fleshy fibres. The outer, which is sometimes divided into several portions, arises, by very distinct aponeurotic fibres, from the inner and upper part of the clavicle, over an extent which varies in different subjects. These two portions of the muscle follow different directions. The first ascends obliquely backwards and outwards, and covers the second, which is nearly vertical. After thus crossing each other, they remain for some time distinct, but are at length confounded, so as to form but a single bundle, terminated by a broad and thin aponeurosis posteriorly, where it is attached to the outside of the upper curved line of the occipital bone, narrow and thicker antericrly, where it is inserted into the mastoid process. At the union of its two portions, or a little above it, the sterno-cleido-mastoideus is obliquely traversed by the spinal accessory nerve.

1022. Its *outer surface* is covered nearly in its whole extent by the platysma myoides, excepting at its upper part, where it lies under the skin and parotid gland. Between it and the platysma myoides are observed the external jugular vein and some nervous filaments of the superficial cervical plexus. Its *inner surface* is applied inferiorly upon the sterno-clavicular articulation, the sterno-thyroideus, sterno-hyoideus, and omo-hyoideus muscles, the internal jugular vein, the trunk of the carotid artery, the pneumo-gastric nerve, the cervical plexus, and the communicating cord of the cervical ganglia. Above, it corresponds to the scalenus, levator anguliscapulæ, splenius, and digastricus muscles, and to the spinal accessory nerve. Its *anterior edge* is very close below to the muscle of the opposite side, but is very widely separated above. Its upper and lower parts are pretty thick, but in the middle it is thin. The *posterior edge* is thin and a little concave.

1023. This muscle carries the head forwards, inclines it to its own side, and makes it perform a rotatory motion which turns the face to the opposite side. When the two muscles act together, the head is directly bent, and in this case the thorax requires to be previously fixed below by the recti abdominis.

2. *Superior Hyoid Region.*

OF THE DIGASTRICUS,* BIVENTER MAXILLÆ.

(*M. Mastoido-Genien,* Chauss.)

1024. This muscle is situated on the lateral, upper and anterior parts of the neck, beneath the under jaw. It is thick and fleshy at its extremities, slender and tendinous at the middle, where it is bent upon itself. It arises posteriorly, by aponeurotic fibres, from the mastoidal groove of the temporal bone, and descends obliquely inwards and forwards, at first broader and thicker, but becoming gradually thinner and changing into a pretty strong rounded tendon, more apparent externally than internally, about two inches long, and which crosses the lower part of the stylo-hyoideus or passes behind it. There it is received into a kind of aponeurotic ring, furnished internally with a small synovial bursa, a line or two in breadth and of variable length, which is attached to the upper edge of the os hyoides, and brings it more or less near to the middle of the muscle. Then a broad and thin aponeurosis is detached from the lower edge of the tendon, which here changes its direction, and is bent upon itself. It descends before the mylo-hyoideus, contracts firm adhesion to it, and is also attached to the body of the hyoid bone. The muscle then ascends forwards and inwards toward the base of the jaw, becomes a second time fleshy and thick, approaches that of the opposite side, and is inserted into a fossa situated upon the sides of the symphysis of the chin, by aponeurotic fibres, which are sometimes interlaced with those of the other muscle.

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* Δὶ, *duo*; γαστὴρ, *venter*; two-bellied.

1025. Its *external surface* is covered posteriorly by the complexus minor, splenius and sterno-cleido-mastoideus ; in the middle, by the maxillary gland, which is lodged in the angle formed by the tendon ; anteriorly, by the platysma myoides. Its *inner surface* lies upon the stylo-hyoideus, stylo-glossus, and stylo-pharyngeus muscles, the external and internal carotid, the labial and lingual arteries, the internal jugular vein, the hypo-glossal nerve, and the hyo-glossus and mylo-hyoideus muscles.

1026. This muscle depresses the under jaw, or raises the os hyoides and carries it forward. Its posterior portion appears to assist in raising the upper jaw, by acting upon the skull.

OF THE STYLO-HYOIDEUS.

1027. This is a long and slender muscle, placed at the upper and lateral part of the neck. An aponeurosis, which is considerably prolonged upon the fleshy fibres, attaches it to the styloid process, near its base, and is separated from the latter by a small synovial bursa. It descends from thence inwards and forwards, following the direction of the posterior belly of the digastricus. It becomes broader, and then generally bifurcates, in a more or less distinct manner, to give passage to the tendon of that muscle. Uniting its two portions again, it is inserted at the lower part and on the sides of the body of the hyoid bone, by short aponeurotic fibres.

1028. Its *outer surface* is covered by the digastric muscle. The *inner* is in relation with the external carotid, the labial and lingual arteries, the internal jugular vein, the stylo-glossus, stylo-pharyngeus, and hyo-glossus muscles, and the hypo-glossal nerve.

1029. It raises the hyoid bone, and consequently the larynx, carrying it at the same time backwards and to a side. When the two muscles act together, the hyoid bone is raised directly and carried backwards.

OF THE MYLO-HYOIDEUS.

1030. This muscle is broad, thin, flat, and of a truncated triangular form. It is situated at the upper and fore part of the neck, behind the lower jaw. It arises, by short aponeuroses, from the internal oblique line of the inferior maxillary bone, between the last molar tooth and the mental process. Its anterior fibres, which are very short, proceed obliquely downwards and inwards, and are confounded with those of the opposite muscle, along a sort of tendinous raphe, which descends from the symphysis of the chin to the hyoid bone, and which degenerates below into a thin aponeurosis united to that of the digastric muscle. The other fibres, which become longer the farther back they are situated, are less and less oblique, so as ultimately to become nearly vertical, They terminate by aponeuroses at the lower and fore part of the body of the hyoid bone.

1031. The *outer surface* of the mylo-hyoideus, which inclines downwards and forwards, is covered by the digastricus and platysma myoides, and by the sub-maxillary gland. The *inner surface* covers the genio-hyoideus, genio-glossus, and hyo-glossus muscles, the sub-lingual gland, the duct of the sub-maxillary gland, the prolongation of that gland, and the lingual nerve.

1032. It raises the hyoid bone and carries it forward, or it depresses the lower jaw.

OF THE GENIO-HYOIDEUS.

1033. This muscle is situated behind the preceding. It is thin, short, flat, narrower above than below. It arises from a kind of small tendon inserted into the lower genial process (290), and descends backwards to be attached to the middle part of the anterior surface of the body of the os hyoides. Its *anterior surface*, which is inclined downwards, is covered by the mylo-hyoideus; the *posterior* is applied upon the genio-glossus and hyo-glossus. Its *inner edge* is contiguous to that of the opposite side, and is often confounded with it.

1034. The action of this muscle is to raise the hyoid bone, carrying it forward, or to depress the jaw.

3. *Inferior Hyoid Region.*

OF THE OMO-HYOIDEUS, OR SCAPULO-HYOIDEUS.

1035. The *Omo-hyoideus* is a very long, slender, flattened, and very narrow muscle, situated obliquely on the sides and fore part of the neck. It arises below, by aponeurotic fibres, longer before than behind, from the upper edge of the scapula, behind the coracoid notch (430), and often from the ligament which converts the latter into a hole. It ascends forwards and inwards, becoming narrower, passes behind the clavicle, sometimes attaching itself to its posterior edge, crosses the direction of the sterno-cleido-mastoideus, and, behind it, is converted into a very thin and narrow tendon, of variable length, always more distinct before than behind. It then becomes fleshy again, increases its breadth, and ascends nearly parallel to the sterno-hyoideus, to terminate by very short aponeuroses on the sides of the lower edge of the body of the hyoid bone.

1036. Its *outer surface* is covered by the trapezius, platysma myoides and sterno-cleido-mastoideus, and by the clavicle. The *inner surface* corresponds to the two scaleni, the anterior branches of the inferior cervical nerves, the trunk of the carotid artery, the internal jugular vein, the superior thyroid vessels, and the sterno-hyoideus and sterno-thyroideus muscles.

1037. This muscle lowers the hyoid bone, carrying it a little backwards and to a side. When it acts along with its fellow, it lowers the bone directly and carries it backwards.

OF THE STERNO-HYOIDEUS.

1038. The *Sterno-hyoideus*, which is placed at the fore part of the neck, and represents a long narrow band, arises behind the clavicular extremity of the sternum, from the posterior sterno-clavicular ligament, and also sometimes from the cartilage of the first rib. It ascends obliquely inwards, contracting a little, and approaching that of the opposite side, as far as the middle of the larynx. It then directs itself a little outwards, and terminates at the lower edge of the body of the hyoid bone, internally of the preceding muscle. It commonly presents, at a variable height, an aponeurotic intersection more visible before than behind, somewhat tortuous, and often only existing on the inside. Its various insertions are effected by means of small aponeuroses.

1039. The *anterior surface* of this muscle is covered by the clavicle, the sterno-cleido-mastoideus, platysma-myoides, and omo-hyoideus muscles, and by the skin. The *posterior surface* is applied upon the sterno-thyroideus, crico-thyroideus and thyro-hyoideus muscles, the thyro-hyoid membrane, the thyroid body, and the superior thyroid vessels. A small synovial bursa exists between it and the crico-thyroid membrane.

1040. It depresses the hyoid bone, and consequently the larynx, and thus furnishes a fixed point to the depressor muscles of the jaw.

OF THE STERNO-THYROIDEUS.

1041. This muscle, which is of the same form as the preceding, and situated behind it, but a little shorter and broader, arises from the upper part of the internal surface of the sternum, opposite the cartilage of the second rib, from whence it ascends, directing itself a little outwards, and contracting, to the thyroid cartilage, on the oblique ridge of which it terminates by short aponeuroses. It also sometimes presents, at its lower part, an oblique or transverse aponeurotic intersection.

1042. Its *anterior surface* is covered by the sterno-hyoideus, sterno-cleido-mastoideus, and omo-hyoideus muscles. The *posterior* covers the subclavian and internal jugular veins, the trunk of the carotid artery, the trachea, the thyroid body and its vessels, the crico-thyroideus muscle, and a part of the constrictor pharyngis inferior.

1043. It acts upon the thyroid cartilage in the same manner as the preceding muscle does upon the hyoid bone.

OF THE THYRO-HYOIDEUS, OR HYO-THYROIDEUS.

1044. It is of a quadrilateral form, very short and thin, and is situated at the middle of the neck upon the larynx. It is often continuous with the preceding by its lower edge, which is attached to the oblique ridge of the thyroid cartilage, and which is consequently inclined downwards and inwards. It ascends from thence parallel to the muscle of the opposite side, and terminates at the lower edge of the body of the hyoid bone, and at the anterior half of the outer edge of its great horn. Its *anterior surface* is covered by the sterno-hyoideus, omo-hyoideus, and latissimus colli. The *posterior* lies upon the thyroid cartilage and the thyro-hyoid membrane. Its use is to bring the larynx and hyoid bone toward each other.

4. *Pharyngeal Region.*

OF THE CONSTRICTOR PHARYNGIS INFERIOR.

1045. This is the largest and longest of the muscles of the pharynx. It is membranous, broad, and of an irregular quadrilateral form. It arises below, sometimes from the first ring of the trachea, by a small number of fibres only, but always from the outer part of the cricoid cartilage, the small horn and the oblique ridge of the thyroid cartilage, behind the crico-thyroideus and sterno-thyroideus. From these different points of attachment, its fibres proceed backwards, inwards, and upwards, so much the shorter the lower they are, and becoming more vertical the higher their situation. In the median line, they are confounded with those of the opposite muscle in a kind of raphe.

1046. Its *outer surface* is covered externally by the sterno-thyroideus, the thyroid body and the trunk of the carotid artery. Posteriorly, it is connected with the rectus capitis anticus major and longus colli muscles, and with the anterior vertebral ligament, by very loose cellular tissue without fat. The *inner surface* is covered by the constrictor medius above; by the palato-pharyngæus and stylo-pharyngæus muscles, and the mucous membrane of the pharynx, in the middle; and by the thyroid and cricoid cartilages below. The *upper edge*, which is very oblique, forms an extremely acute angle with that of the opposite side, and ascends more or less high, sometimes to near the occipital bone. The *lower edge*, which is shorter, is nearly transverse. It is connected with the commencement of the œsophagus, and allows the inferior laryngeal branch of the pneumo-gastric nerve to pass under it anteriorly.

OF THE CONSTRICTOR PHARYNGIS MEDIUS.

1047. This muscle, which is also membranous, and nearly triangular, arises from the retiring angle formed by the union of the large and small horns of the hyoid bone, and from the whole extent of these two bony appendages, as well as from the stylo-hyoid ligament. The inferior fibres, which are shorter, are directed downwards and backwards; the middle fibres are transverse; and the superior, which are longer, ascend obliquely. They are all interlaced with those of the opposite side, forming at the posterior part of the pharynx a raphe, whose inferior extremity, which is very much attenuated, is concealed by the preceding muscle, while the upper, which is also very acute, is attached to the basilar process by a kind of aponeurosis. Some of the fibres of this muscle are frequently continuous internally with those of the genio-glossus.

1048. The constrictor medius is covered, in its *outer surface*, by the hyo-glossus and lingual artery externally, and by the constrictor inferior behind and below. In the rest of its extent, it is united by cellular tissue to the muscles of the anterior occipito-cervical region and to the anterior vertebral ligament. The *inner surface* is covered by the mucous membrane of the pharynx, the stylo-pharyngeus, pharyngo-staphylinus and constrictor superior.

OF THE CONSTRICTOR PHARYNGIS SUPERIOR.

1049. Membranous and broad like the others, but still thinner, and of an irregularly quadrilateral form, it arises externally from a considerable number of different parts: 1. from the lower half of the edge of the internal wing of the pterygoid process; 2. from an aponeurosis which is common to it with the buccinator, and which extends from the pterygoid process to the posterior part of the inferior alveolar arch; 3. from the extremity of the myloid line (290;) 4. from the sides of the base of the tongue, betwen the stylo-glossus and hyo-glossus. It sometimes even arises a little from the tuberosity of the palate bone, the internal peristaphyline muscle, or the stylo-pharyngeus, and from the styloid process. The fleshy fibres of the first origin descend a little backwards and presently ascend towards the base of the skull, so as to form a sort of arch. They are attached to a thin and yet firm aponeurosis (the *cephalo-pharyngeal*,) which is attached to the basilar process, but only by its extremities, and so as to leave an empty space between the bone and its middle part. The other fibres proceed in a transverse direction to be interlaced with those of the opposite muscle in the middle of the posterior part of the pharynx.

1050. The *outer surface* of this muscle is covered posteriorly by the constrictor medius, and laterally is in connection with the stylo-glossus, stylo-pharyngæus, the internal carotid artery, the internal jugular vein, the pneumo-gastric, hypo-glossal and spinal accessory nerves, and several filaments of the superior cervical ganglion. These different parts are contained in a triangular space filled with cellular tissue, and which occurs between the constrictor pharyngis superior and pterygoideus internus. Its *inner surface* covers the palato-pharyngæus and levator palati mollis, and is lined by the mucous membrane of the pharynx.

1051. From the description of these muscles, it will be seen that they all three cover each other, in such a manner that the lower only remains visible in its whole extent, and they also all unite in the middle of the pharynx with those of the opposite side by a sort of raphe.

1052. The constrictors of the pharynx contract that portion of the digestive canal when it is filled with alimentary substances. The constrictor medius moreover raises the os hyoides and the larynx, carrying them backwards, and the inferior raises a little the larynx only.

OF THE STYLO-PHARYNGÆUS.*

1053. The *Stylo-pharyngæus* is narrow above, broad and flat below, and of an elongated form. It is situated on the side and back part of the pharynx. It arises by short aponeurotic fibres, from the inner part of the styloid process of the temporal bone, near its base, and descends inwards and backwards toward the pharynx, passes under the constrictor medius, expands, confounds the greater part of its fibres with those of the other muscles of this region, and sends some to the thyroid cartilage and hyoid bone.

1054. Its *outer surface* is covered by the stylo-hyoideus, constrictor pharyngis medius, and external carotid artery. The *inner* surface is in connection with the internal carotid artery, the internal jugular vein, the membrane of the pharynx, and the constrictor superior and palato-pharygæus muscles.

1055. This muscle shortens the pharynx by raising its lower part. It also raises the larynx.

5. *Posterior-Cervical Region.*

OF THE TRAPEZIUS OR CUCULLARIS.

1056. The *Trapezius* is a thin, membranous, triangular muscle, situated at the posterior part of the neck and shoulder, and at the upper part of the shoulder. It arises from the inner third of the upper curved line of the occipital bone, from the whole length of the superficial cervical ligament (603), the spinous processes of the seventh cervical and all the dorsal vertebræ, as well as from the interspinal ligaments by which they are connected. All these origins take place by aponeuroses. That from the occipital bone presents a thin and broad aponeurosis, the fibres of which are frequently more than an inch in length. Along the cervical ligament the fibres of these aponeuroses are very short; but from the sixth cervical to the third dorsal vertebra inclusive, they acquire considerable size, and form a membrane which represents the half of an ellipse. They then shorten again, to be elongated a second time at the lower part of the back, where there is observed a triangular and pretty long aponeurosis. The fleshy fibres succeed these aponeuroses. Those which come from the occipital bone and cervical ligament descend obliquely outwards and forwards, turn upon themselves, and terminate at the outer third of the posterior edge of the clavicle. Those which arise from the last cervical vertebra and the upper dorsal, are shorter than the others, and proceed horizontally outwards, to be attached to the acromion, the acromio-clavicular ligament, and the spine of the scapula, by long aponeurotic fibres, very strong and very distinct. All the others, which are the more oblique the lower they are, ascend outwards toward the inner extremity of the spine of the scapula, and there degenerate into a triangular aponeurosis which slides, with the assistance of a very loose tissue, over a bony surface of the same form, and whose summit is attached to a small tuberosity.

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* M. Chaussier admits only a single muscle on each side of the pharynx. It is formed of all those which we have described above, and is named by him *Stylo-pharyngæus.*

1057. The *posterior surface* of this muscle is entirely covered by the skin, from which it is separated by a cellular tissue containing little fat, and denser above than below. The *anterior surface* is applied, at its upper and inner part, upon the complexus major; farther down, upon the splenius, levator anguli scapulæ, and serratus posticus superior. At its lower part, it covers the supra-spinatus, infra-spinatus, rhomboideus, latissimus dorsi, and sacro-spinalis muscles, and the inner extremity of the spine of the scapula. The layer of cellular tissue interposed between it and these different parts is in general rather thin, excepting toward those above the spine of the scapula.

1058. When the whole of the trapezius contracts at once, it carries the shoulder and clavicle backwards. Its upper fibres directly elevate the tip of the shoulder, the lower indirectly. When both trapezii act together, the two scapulæ are brought nearer each other and carried backwards. When the shoulder is fixed, it extends the head and inclines it laterally.

OF THE RHOMBOIDEUS.

(*M. Dorso-Scapulaire*, Chauss.)

1059. The *Rhomboideus* is a thin flat muscle, of a nearly square form, occupying the upper part of the back and the lower part of the neck. It is divided by a cellular line into two portions which have been considered as distinct muscles. Of these the upper is smaller, the lower larger. It arises by aponeurotic fibres, longer below than above, from the lower part of the superficial cervical ligament, the spinous process of the last vertebra of the neck, those of the first four or five dorsal vertebræ, and from the corresponding interspinal ligaments. The fleshy fibres, which are all parallel, descend a little outwards, to the spinal edge of the scapula, where they are attached; but in the middle, they are inserted along a sort of aponeurotic arch, vertical and parallel to the edge of the scapula, with which it is only connected by its two extremities, being separated from it in the rest of its extent by cellular tissue which is traversed by vessels.

1060. The *posterior surface* of the rhomboideus is in a great part covered by the trapezius. At its lower part, it is covered by the latissimus dorsi, and between these two muscles, is in contact with the skin. The *anterior surface* covers the serratus posticus superior, the splenius, sacro-spinalis, and part of the intercostales externi. It is also applied over some of the ribs. Its *upper edge* is covered, in nearly its whole extent, by the levator anguli scapulæ.

1061. The principal action of the rhomboideus is to bring the scapula toward the trunk. It also lowers the tip of the shoulder, by bringing the lower angle of the scapula toward the vertebral column.

OF THE SPLENIUS.

(*M. Cervico-Mastoidien et Dorso-Trachelien*, Chauss.; *Musculi Splenius Capitis et Splenius Cervicis*, Soemm.)

1062. The *splenius* is an elongated, flat, although pretty thick muscle, much broader above than below, situated obliquely at the back of the neck and upper part of the back. It arises by aponeurotic fibres, which are longer below than above, from the spinous processes of the first five or six dorsal vertebræ, from their interspinal ligaments, from the spinous process of the last cervical vertebra and from the lower part of the superficial cervical ligament, as far as the third vertebra. From these different points of attachment, arise the fleshy fibres, which form a bundle whose thickness and breadth continue to increase as it recedes from them. It ascends outwards, leaving between it and its fellow a triangular interval, in which is seen the complexus major. On arriving at the middle part of the neck, it separates into two portions. The lower and outer of these, which bears the name of *splenius cervicis*, is narrower, and is itself divided into three small bundles, which are attached by an equal number of thin and slender tendons, longer internally than externally, to the transverse processes of the first two or three cervical vertebræ, where they are often confounded with the tendons of the transversus cervicis, levator anguli scapulæ, scalenus posticus, and first inter-transversus colli. The other portion, which is superior and internal, and is called the *splenius capitis*, is larger, continues to ascend, and terminates, by short aponeurotic fibres, at the outer half of the rough impression which is observed between the two curved lines of the occipital bone, at the mastoid portion, and the whole outer edge of the mastoid process of the temporal bone, below the insertion of the sterno-cleido-mastoideus.

1063. The *posterior surface*, of the splenius is covered above by the sterno-cleido-mastoideus; in the middle, by the trapezius and levator anguli scapulæ; below, by the serratus posticus superior, and rhomboideus. The *anterior surface* lies upon the complexi, longissimus dorsi, and transversus colli.

1064. The splenius extends the head, inclining it laterally, and impresses upon it a rotatory motion which turns the face to one side. When the two muscles act together, they extend the head directly.

OF THE COMPLEXUS* MAJOR.

(*M. Trachelo-occipital*, Chauss.)

1065. The *Complexus major* is a pretty thick elongated muscle, much broader at the middle part and above than below, where it is prolonged into a very slender point. It is situated under the splenius. It arises from the transverse and articular processes of the last six cervical, and from the transverse processes of the first four or five dorsal vertebræ, by as many small tendons whose fibres are strongly interlaced with the fleshy fibres, and much more distinct below than above. They are frequently confounded with those of the transversus colli. It also frequently arises, by other small tendons, from the spinous processes of the seventh cervical and first two dorsal vertebræ.

To all these tendons succeed the fleshy fibres, which, from being at first disposed in isolated fasciculi, are soon intimately confounded. Those which come from the third, fourth, and fifth transverse processes of the back, form a separate band, which ascends obliquely inwards, and terminates anteriorly by a small tendon broader at its extremities than in the middle, which occupies the middle third of the inner edge of the muscle, and sends from its upper part other fleshy fibres which ascend to the occipital bone. The fleshy fibres which proceed from the six transverse processes of the neck and the two first of the back, ascend less obliquely, and are arrested by an aponeurotic intersection in the form of the letter V, more distinct internally than externally, and directed transversely, which occurs about the middle of the muscle and occupies its whole breadth. From the upper edge of this intersection proceed other fleshy fibres which ascend a little inwards, and are attached to the inner part of the impression which is observed between the two curved lines of the occipital bone, by aponeuroses which are prolonged very far among the fleshy fibres.

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* *Complexus*, embracing several things, complicated.

1066. The *posterior surface* of the complexus major, which is turned a little outwards, is covered successively, from above downwards, by the trapezius, splenius, complexus minor, transversus colli, and longissimus dorsi. The *anterior surface* is applied, from below upwards, upon a part of the semi-spinales colli, upon the deep cervical artery, the posterior branches of the cervical nerves, and the posterior recti and obliqui of the head. Its *inner edge* is removed to a distance from that of the opposite muscle, but it approaches it as it ascends, and from about the middle of the neck, is only separated by a line of cellular tissue. The *outer edge* is free, from the second vertebra to the occipital bone.

1067. This muscle prevents the head from being bent, or raises it when it has been bent. When it acts by itself, it extends the head, inclining it to its own side, and turning it by rotation to the opposite side. When the two act together, the head is directly extended.

OF THE COMPLEXUS MINOR, OR TRACHELO-MASTOIDEUS.

1068. The *complexus minor* is much smaller than the preceding muscle. It is situated externally of it, and lies upon its outer edge, like a fleshy tongue, at the back part and on the sides of the neck. It is long, slender, flattened, broader above than below, and arises from the last four transverse processes of the neck, sometimes from the first of the back, by tendinous and fleshy tongues which are almost immediately confounded together. These small tendons, which vary very much in size, are the more distinct the lower they are. The fleshy fibres by which they are succeeded, form by their union a bundle which ascends vertically, becoming broader, to the mastoid process, behind which it is inserted by a flat tendon which existed for some time previously in the substance of the muscle. The muscle is also frequently intersected by aponeuroses, varying much in their number, direction, and position; or it receives, in the middle of its inner edge, a fleshy band which is sent off by the longissimus dorsi.

1069. The *posterior surface* of the complexus minor, which inclines outwards, is covered above by the splenius, and below by the transversus colli, with which it is united. The *anterior surface* is applied upon the complexus major, in almost its whole extent, and especially at its inner part. It also covers, at its upper part, the obliqui capitis, the posterior extremity of the digastricus, and the occipital artery.

1070. This muscle inclines the head a little without rotation, when it acts by itself, or reverses it slightly when both muscles act.

6. *Lateral Cervical Region.*

OF THE SCALENUS ANTICUS, SCALENUS PRIOR.

(*M. Costo-Trachelien*,* Chauss.)

1071. The *Scalenus Anticus* is a long flat muscle, simple and broader below, narrow and divided into several portions above, situated upon the lateral and inferior parts of the neck. It is attached by a tendon which expands over the fleshy fibres, to the outer surface and upper edge of the first rib, toward the middle of its length, and ascends a little obliquely inwards and backwards, dividing immediately into four fleshy tongues connected by their neighbouring edges, and giving rise to as many small tendons, of which the upper are longer than the others. Each of them is inserted, by means of these tendons, into the anterior tubercle of one of the transverse processes of the neck, from the third to the sixth inclusive.

1072. The *anterior side* of this muscle is covered below by the subclavian vein ; higher up, by the transverse and ascending cervical arteries, the diaphragmatic nerve, and the omo-hyoideus and sterno-cleido-mastoideus muscles. Its *posterior side* forms with the next muscle a triangular space, broad below, contracted above, in which are lodged, inferiorly, the subclavian artery, and superiorly, the branches of the cervical nerves, which form the brachial plexus. Its *inner side* is separated from the longus colli by the vertebral artery and veins.

1073. This muscle bends the cervical portion of the spine laterally and forwards. It also assists in inspiration, by raising the first rib.

OF THE SCALENUS POSTICUS.† ‡

1074. Longer and larger than the preceding, but of the same form, and placed farther back, the scalenus posticus arises below from the outer surface of the first rib, from a rough impression which is observed behind the passage of the subclavian artery, and from the upper edge of the second rib. These two origins take place by aponeurotic fibres which are prolonged to a great distance among the fleshy fibres. The second origin is sometimes wanting, and is always smaller than the first. The muscle which is here separated into two distinct bundles, soon unites, although it is sometimes separated in its whole length, ascends a little obliquely inwards and forwards, and terminates by six small tendons, of which the superior are the longest, on the posterior tubercle of the last six transverse processes of the neck. It is observed, in some cases, that a small bundle proceeds from the portion attached to the axis to ascend to the transverse process of the atlas.

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* M. Chaussier considers this muscle and the following as only forming one and the same organ.

† Soemmering divides this muscle into three, which he distinguishes by the names of *Scalenus lateralis*, *medius*, and *posticus*.

‡ The *Scalenus posticus*, as described by M. Cloquet, includes the *Scalenus Medius*, and *Scalenus posticus* of British writers.—K.

1075. Between the two scaleni there is commonly found a small fleshy bundle which proceeds from the upper edge of the first rib, to the transverse processes of the seventh and sixth vertebræ, or to that of the seventh only. It is placed behind the subclavian artery, and before the anterior branches of the two last cervical nerves. This is the *scalenus minimus* of Soemmering.

1076. The *anterior side* of the scalenus posticus corresponds to the preceding muscle, from which it is separated below by the subclavian artery, and above by the anterior branches of the cervical nerves. The *posterior side*, which is very narrow, is in connection with the sacro-lumbalis, transversalis colli, splenius, and levator anguli scapulæ. The *inner* covers the first external intercostal muscle at its lower part, and at the upper the summits of the last six transverse processes of the neck, and between them the posterior intertransversales muscles. Lastly, the *outer* side, which is broad above and narrow below, is covered by the serratus magnus below; in the middle, by the transverse cervical artery, the skin, a great number of lymphatic ganglia, and nervous filaments of the cervical plexus; at its upper part, by the sterno-cleido-mastoideus.

1077. This muscle has the same uses as the scalenus anticus, but it draws the vertebral column a little backwards.

IV. MUSCLES OF THE PELVIS.

1. *Anal Region.*

OF THE LEVATOR ANI.

(*M. Sous-Pubio-Coccygien*, Chauss.)

1078. This muscle completes the lower wall of the abdomen, forming, at the lower part of the pelvis, a sort of concave floor, which sustains the inferior part of the rectum and the bladder, around which it constitutes a kind of cincture which also embraces the commencement of the urethra and the vesiculæ seminales. It is thin, membranous, irregularly quadrilateral, broader above than below, and arises, by short aponeurotic fibres, from the inferior and posterior part of the symphysis pubis, from the ossa ilii, from above the upper region of the obturator internus, from the sciatic spine, and from a broad and thin aponeurosis which covers the obturator internus, and which is sometimes continuous with a fibrous lamina detached from the psoas parvus. These different origins, which are continuous with each other, are only a little interrupted, toward the obturator hole, for the passage of the obturator nerve and vessels. The middle and anterior fleshy fibres descend from without inwards and from before backwards. They unite behind and beneath the rectum, with those of the opposite side, and envelope that intestine in a radiating manner. Some of the more anterior seem to be attached to the prostate gland or to be confounded with the sphincter ani. Others, proceeding from the angle of union of the corpora cavernosa of the penis with the urethra, expand posteriorly over the bulb of that canal. The posterior descend inwards and terminate below the sides of the coccyx, forming a tendinous line.

1079. The *outer surface* of this muscle corresponds to the obturator internus, with which it is connected by a layer of cellular tissue, thin above and very thick below, to the glutæus maximus and transversus perinæi, as well as to the fat which surrounds the anus. Its *inner surface* corresponds anteriorly to the bladder and prostate gland, and embraces the lower part of the rectum. Its *posterior edge* is continuous with the coccygeus muscle.*

1080. In the female, this muscle adheres strongly to the vagina before arriving at the rectum. It is weaker than in the male, and its fibres, especially the posterior, are less curved.

1081. This muscle raises and carries forward the rectum, which it compresses, at the same time that it resists the action of the diaphragm and abdominal muscles. It also favours the ejaculation of the spermatic fluid and the expulsion of the urine. In the female it contracts the vagina a little.

OF THE COCCYGEUS, OR ISCHIO-COCCYGEUS.

1082. The *Coccygeus* is of a triangular form, thin, and flat, and concurs, with the preceding, behind which it is placed, to form the floor of the abdominal cavity. Attached to the inside of the sciatic spine, it descends enlarging to be attached to the whole edge of the coccyx and the lower part of the lateral surface of the sacrum. It is even prolonged a little upon the anterior surface of that bone. This muscle is a mixture of fleshy and aponeurotic fibres, which seem to be confounded in an intimate manner with those of the anterior or sacro-sciatic ligament. It frequently receives, from the lower part of the sacrum, a small bundle, (the *Curvator coccygis* of Soemmering) thin, slender, descending over the middle of the coccyx, and uniting with the two muscles at once.

1083. Its *posterior surface*, which inclines downwards, is covered by the two sacro-sciatic ligaments. The *anterior* corresponds to the rectum and the cellular tissue which surrounds it.

1084. It retains the coccyx, and prevents it from being turned backwards during the excretion of the feces. Its motions are not very decided.

OF THE SPHINCTER ANI, CONSTRICTOR ANI.

(*M. Coccygeo-Anal*, Chauss.)

1085. This is an oval membranous muscle which surrounds the anus. It is attached to the tip of the coccyx by a sort of cellular tendon, from which arise two fleshy bundles, which, passing over the sides of the anus, unite again before it to form a fleshy point which is partly confounded with the accelerator urinæ, and is partly expanded in the cellular tissue. The fibres of this muscle are concentric and semi-elliptical, and are interlaced with each other in the median line, forming acute angles. In the female, its anterior portion is much more rounded than in the male.

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* On the inner surface of the levator ani muscle, and betwixt it and the peritoneum an important fascia exists; it is generally called the pelvic fascia. Its position and general connections ought to be particularly attended to by the dissector.—K.

1086. Its *inferior surface* is covered by the skin. The *upper* corresponds to the levator ani, from which it is almost every where separated by cellular tissue, but with which it is intimately confounded near the rectum. Anteriorly, it also unites in part with the accelerator urinæ and transversus perinæi.

1087. This muscle closes the anus and wrinkles the surrounding skin. In the male, it draws the bulb of the urethra backwards.

2. *Genital Region.*

a. IN MAN.

OF THE ERECTOR PENIS, ISCHIO-CAVERNOSUS.

(*M. Ischio-Urethral*, Chauss.)

1088. This is a small elongated flat muscle, broader in the middle than at its extremities, and which surrounds the origin of the corpus cavernosum. Fixed to the inner side of the sciatic tuberosity, it ascends forwards and inwards, and degenerates into a white and strong aponeurosis, which is identified, beyond the level of the bulb of the urethra, with the fibrous membrane of the corpus cavernosum, over which it is applied by its *outer surface*, which moreover corresponds to the ramus of the ischium, while its outer surface is in connection with the transversus perinæi and accelerator urinæ, from which it is separated by much adipose cellular tissue, together with vessels and nerves.

It draws the root of the penis downwards and backwards.

OF THE ACCELERATOR URINÆ, BULBO-CAVERNOSUS.

(*M. Bulbo-Urethral*, Chauss.)

1089. This muscle is long, flat, broader behind than before, and situated in the perineum, beneath the bulb of the urethra and the root of the penis. It arises between these parts and the anus, where it is confounded with the transversus perinæi, sphincter ani and levator ani. It is then separated from its fellow only by a tendinous line, but separates from it before, proceeding outwards, and leaving an interval in which are seen the canal of the urethra and a portion of the corpus cavernosum. Its fibres, which are nearly transverse and very short behind, oblique and longer before, terminate, the first on the sides of the bulb of the urethra, the others below the corpus cavernosum, where they are confounded with its membrane.

1090. The *upper* surface of this muscle covers the bulb and the commencement of the spongy portion of the urethra, as well as the corpus cavernosum. The *lower surface* is covered by the skin, the sphincter ani, and erector penis, from which it is separated by much cellular tissue.

1091. This muscle compresses the posterior part of the canal of the urethra, which it carries backwards and upwards. It accelerates the ejection of the urine and seminal fluid.

OF THE TRANSVERSUS PERINÆI.

1092. This is a small flat, thin, irregular muscle, varying much in form, more commonly triangular, sometimes composed of several separate bundles, and situated at the posterior part of the perinæum. It is pretty frequently wanting in women. It arises, by short aponeuroses, from the inner part of the tuberosity of the ramus ischii, above the erector penis and root of the corpus cavernosum, directs itself inwards and a little forwards, and terminates at a tendinous line placed between it and its fellow, being also in part confounded with the accelerator urinæ and sphincter ani, and in the female with the constrictor vaginæ also. Sometimes all its fibres unite with the accelerator urinæ; they are always longer behind and below, than before and above.

1093. The *anterior surface* of the transversus perinæi, which is inclined downwards, corresponds to the erector penis and accelerator urinæ, and to a mass of cellular tissue, which fills up their interval. The *posterior surface* is covered by the levator ani, from which it is separated by much cellular tissue, and externally by the deep branch of the internal pudic artery.

1094 It concurs with the accelerator urinæ, to compress the urethra; and with the levator ani, it supports the lower part of the rectum and the bladder.

b. IN WOMAN.

OF THE ERECTOR CLITORIDIS, OR ISCHIO-CAVERNOSUS.

1095. It presents nearly the same arrangement as in the male, but is much smaller. It arises by aponeuroses, from the tuberosity of the ischium, and terminates by embracing the cavernous body of the clitoris, to the erection of which it appears to contribute.

OF THE CONSTRICTOR VAGINÆ.

(*M. Perinæo-Clitorien*, Chauss.)

1096 This muscle forms a sort of fleshy ring, much more distinct in young women than in such as have born children. It is formed of two planes of fibres, which arising, so to speak, from the proper tissue of the vagina, are interlaced, between the anus and vulva, with the sphincter ani and transversus perinæi, and frequently receive a bundle from the internal region of the sciatic tuberosity. They turn on either side around the orifice of the vagina, degenerate into an aponeurotic tissue, and lose themselves in the fibrous membrane of the cavernous body of the clitoris.

This muscle contracts the orifice of the vagina, which it embraces.

IV. MUSCLES OF THE ABDOMEN.

1097. The *Abdomen* is an oblong cavity, of variable size, convex before and especially below, concave behind and on the sides, situated under the thorax, and above the inferior extremities. It contains the principal viscera of the body, and is divided into several regions, which we shall make known as we proceed.* †

1. *Anterior Abdominal Region.*

1098. Along the middle part of the abdomen, from the ensiform cartilage to the symphysis of the pubes, there is observed a strong tendinous cord, which obtains the name of *Linea alba*. Its lateral limits are not well determined. It is broader above than below, and occupies the interval between the two recti muscles of the abdomen, presenting about its middle a cicatrix, which is named the *umbilicus*, and which is its firmest point. This cicatrix replaces an opening which in the fetus gave passage to the urachus and the parts which constituted the umbilical cord. It is deeper and more distinct the older a person is, and adheres strongly to the integuments, so that in fat people, it appears much more sunk than in others. Its circumference, which is thick and very hard, is irregularly quadrilateral, and formed of four planes of albugineous fibres bent upon themselves, and crossing each other at their extremities. Between these four planes is the trace of the aperture, which is very close, but which yet allows a probe to penetrate obliquely downwards between the peritoneum and the anterior wall of the abdomen. This passage is rendered the more difficult by its centre being formed of a solid and elastic bridle, representing the summit of a kind of pyramid, of which the base corresponds to the liver, the two iliac regions, and the upper part of the bladder, and which is constituted by the umbilical vessels, and urachus transformed into true ligaments, which have contracted intimate adhesions to the circumference of the aperture.

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* See the article Peritoneum in a subsequent part.

† Interposed betwixt the integuments and abdominal aponeurosis, the student will observe the *fascia superficialis*, extending over the abdominal region downwards over the front of the thigh. Like most other fasciæ, described by writers on Surgical Anatomy, it is composed chiefly, if not wholly, of cellular membrane. This facia extends likewise over the inguinal ring, and consequently forms one of the layers to be cut through in the operation for strangulated inguinal hernia. As it covers the fore part of the thigh, it seems almost unnecessary to remark, that it will also be found interposed between the sac of the *crural* hernia and the integuments.

1099. The *Linea alba*, whose use is to limit the motions of the thorax backwards, to prevent it from separating too far from the pelvis, and to furnish a fixed point to the abdominal muscles for their contractions, divides to the right and left, for the latter purpose, into two aponeurotic laminæ of different dimensions, and situated the one before the other.

1100. The more superficial of these laminæ passes before the rectus abdominis, and having arrived at its outer edge, divides into two other laminæ, of which the posterior, united to a deeper lamina, goes to furnish points of attachment to the obliquus internus abdominis, while the anterior affords similar attachment to the obliquus externus. Behind them, but in their lower fourth only, is another lamina, which belongs to the transversus abdominis.

1101. The lamina which belongs to the obliquus externus is thin, elongated, less broad above than below, contracted in the middle, so as to terminate by its concave edge outwards. It occupies the whole anterior part of the abdomen, and is thicker and more elastic the lower it is examined. Above the umbilicus, it is transparent and formed of fibres running obliquely outwards and upwards, which are confounded, near the base of the thorax, with the lower insertions of the pectoralis major. At the upper and outer part, these fibres are manifestly intersected at right angles by other very distinct fibres passing obliquely inwards and upwards. Beneath the umbilicus, the fibres are much stronger, and form an opaque layer which no longer permit the fleshy bodies situated under it to be distinguished. They are disposed in small bands parallel to each other, and passing obliquely upwards and backwards, which gives the aponeurosis the appearance of a web merely warped; but, about the distance of an inch and a half from the pubes, it forms an interlaced tissue. These other small bands cross the direction of the first in various ways, most of them however being transverse, and proceed as far as the superior and anterior iliac spine. Several of them are curved, their convexity being directed downwards. Then the aponeurosis divides internally into two bands, of which the upper, which is curved, broader and thinner, is inserted upon the edge of the angle of the pubes, intercrossing with that of the opposite side, and becoming confounded with the fibres of the symphysis pubis and the suspensory ligament of the penis; while the other, which is inferior, straight, less broad, but thicker and stronger, descends obliquely forwards and inwards, above the femoral notch, and terminates at the spine of the pubes. These two bands have generally been called the *pillars of the inguinal ring*, because from their separation results the aperture of that name. It is rather triangular than elliptical, sometimes oval, directed obliquely downwards and inwards, situated above the pubes, broader above than below, where it terminates in a point. The size of the inguinal ring varies in different individuals; but it is always more dilated, situated less laterally, and more elevated in man than in woman. In the former, it gives passage to the spermatic cord and cremaster muscle; in the latter, to the round ligament of the uterus.

Lastly, The aponeurotic lamina of the obliquus externus abdominis terminates, at the lowest part, by a very thick, large and strong fold, fixed on the one hand to the anterior and superior iliac spine, and on the other to the angle, crest, and spine of the pubes. It is to the second of these latter insertions, which takes place by a falciform aponeurotic expansion, that the name of *Gimbernat's Ligament* is now commonly given. The fold in question is much more distinct internally than externally, and is longer in the female than in the male. It is commonly designated by the names of *Poupart's Ligament*, *Fallopius's Ligament*, and *Crural Arch.* It converts into a true hole the great notch which the anterior edge of the os innominatum presents, and thus forms the anterior side of an aperture which appears triangular when it is examined behind, after the peritoneum has been removed, and of which the inner side is formed by the horizontal branch of the pubes, and the outer by the tendon of the united iliacus and psoas muscles. This aperture, which is closed anteriorly by Poupart's Ligament, is traversed by the tendon just mentioned, the femoral vessels, and the crural nerve. It is larger in the female. Lastly, this same fold or crural arch, contains in its substance, but only in a part of its length, the inguinal canal, and is continued in the inguinal region, inferiorly and internally into the fascia lata, by a superficial fibrous lamina.

In its whole extent, this lamina of the abdominal aponeurosis presents quadrilateral apertures of variable diameter, through which vascular and nervous branches pass from the fleshy layer of the abdomen to the integuments.

1102. The deep lamina which separates from the edge of the linea alba, passes before the peritoneum and behind the rectus muscle, but only in the three upper fourths of its extent, and is also divided into two laminæ opposite its outer edge. One of these laminæ, the more superficial, which is almost immediately united to the posterior division of the preceding lamina, forms a thin aponeurosis, much broader above than below, on the outside of which are inserted the fleshy fibres of the obliquus internus. The other joins by its outer edge a small separate lamina, which prevails before the lower fourth of the rectus muscle (1100), and thus constitutes a semicircular aponeurosis, of which the convex edge, which is directed outwards, gives attachment to the fleshy body of the transversus muscle, and whose anterior surface is, for a considerable length, confounded with the lamina of the obliquus internus.

1103. We ought also to remark here that the psoas magnus and iliacus internus, which issue united through the crural arch, are covered and kept in their place in the iliac fossa, by an aponeurotic lamina to which modern anatomists have given the name of *fascia iliaca*, and in which is confounded the tendon of the psoas parvus, when that muscle exists. *Externally*, it descends on the one hand, toward the thigh along with the psoas and iliacus muscles, while on the other it unites intimately with the ligament of Fallopius, so as very accurately to close the crural arch from the anterior and inferior spine of the iliac bone to the ilio-pectineal eminence. *Internally*, it is attached to the crest of the pubes, passes before the pectineus muscle, is prolonged into the hollow of the groin, and is there continued into the deep lamina of the fascia lata.

OF THE OBLIQUUS ABDOMINIS EXTERNUS, OR COSTO-ABDOMINALIS.

1104. The *obliquus abdominis externus* is one of the largest muscles of the body. It represents a kind of fleshy membrane, irregularly quadrilateral, curved backwards, and occupying the side and fore part of the abdomen. It arises posteriorly from about the two anterior thirds of the outer edge of the crista ilii, by short aponeurotic fibres which are continuous with those of the fascia lata. Anteriorly, it comes from the superficial lamina of the abdominal aponeurosis, (1103.) The fleshy fibres of the first origin ascend nearly vertically, and are attached to the inferior edge of the last three ribs by digitations which are covered by those of the latissimus dorsi, with which they are interlocked, (884.) Those which proceed from the aponeurosis, are so much the shorter and more oblique the higher they are, and are continuous with the preceding. They proceed to the lower edge of the fifth and sixth ribs, where they seem to join the pectoralis major, and to the outer surface of the seventh, eighth, and ninth ribs, where they are attached by very distinct digitations, longer and broader than those of the latter ribs, and of which the upper edge is attached to a ridge running obliquely downwards and backwards, which also gives insertion to the serratus magnus, so that there is a distinct interlocking here also, (851.) Their summit is very elongated, and terminates in a small tendon at the lower edge of the rib.

All the digitations of the obliquus externus form together a curved line, the concavity of which is turned downwards, because the attachment of the highest takes place very near the cartilage of the rib to which it belongs, and those of the next digitations, as far as the fifth, inclusively, separate more and more, to approximate gradually again in the last, so that the last of all is attached to the lower edge and the summit of the cartilage.

1105. The *outer surface* of this muscle is covered by the skin, and frequently at the back part by the latissimus dorsi. At other times, there exists between these two muscles a triangular space in which the obliquus internus appears a little. Its *outer surface* covers the anterior part of the last seven or eight ribs and their cartilages, the corresponding intercostal muscles, and the obliquus internus.

1106. This muscle compresses the abdomen, depresses and carries backwards the ribs, acts in strong exspiration, and makes the thorax perform a rotatory motion which turns it to the opposite side. It draws up the trunk, when it has been bent backwards, or maintains it in its natural erectness. When the two muscles act together, they bend the thorax directly. If they take their fixed point in the thorax, as when one is lying on his back, they raise the pelvis and inferior extremities.

OF THE OBLIQUUS INTERNUS ABDOMINIS, OR ILIO-ABDOMINALIS.

1107. The *obliquus internus* is broad, thin, and irregularly quadrilateral, like the externus, beneath which it is extended. It is distinctly narrowed behind, where it is attached to the upper part of the crural arch to near the inguinal ring, to the three anterior fourths of the interstice of the iliac crest, between the obliquus externus and transversus muscles, and to a thin and pretty broad aponeurosis, with fibres running obliquely outwards and upwards, situated behind the inferior bundle of the sacro-spinalis muscle, and before the aponeurosis of the latissimus dorsi, from which it cannot be separated, continuous also above with that of the serratus posticus inferior, and attached to the last spinous processes of the loins, to the sacrum, and to the most remote part of the iliac crest. The fleshy fibres which succeed to this aponeurosis are not very numerous. They ascend almost vertically, and terminate by very short aponeuroses, at the lower edge of the cartilage of the last rib. Those which have their origin from the crest of the iliac bone pass obliquely upwards and forwards, and their obliquity, as well as their length, increases the more anteriorly they are examined, so that when close to the superior iliac spine they are almost horizontal. The posterior fibres terminate by short aponeuroses, at the lower edge of the cartilages of the eleventh, tenth, and ninth ribs, where they are confounded with the intercostal muscles in their interval; and the others are distributed along the middle lamina of the abdominal aponeurosis, (1102.) Lastly, the fleshy fibres which rise from the crural arch, descend inwards, and also terminate in the same lamina. About nine lines from the summit of the inguinal ring, they open to allow the spermatic vessels to pass. Some of them pass through the ring, under the name of *Cremaster muscle*, and accompany the spermatic cord. This disposition is observed only in man, there being nothing of the kind in the female.

1108. The obliquus internus is covered in its *outer surface* by the externus, and posteriorly by the latissimus dorsi. Its *inner surface* is applied upon the sacro-spinalis and transversus abdominis.

OF THE TRANSVERSUS ABDOMINIS, OR LUMBO-ABDOMINALIS.

1110. This muscle is nearly of the same form as the last described, and is situated behind it. It arises above from the inner surface of the cartilages of the sixth, seventh, eighth, ninth, and tenth ribs, by digitations which are interlocked with those of the diaphragm; then from the greater part of the lower edge of the eleventh and twelfth, by very distinct tendinous fibres; inferiorly, from the three anterior fourths of the inner lip of the crest of the ilium, to the inside of the obliquus internus, and from the two outer thirds of the crural arch, by short aponeurotic fibres. At the middle, its fleshy fibres arise from an aponeurosis which proceeds backwards dividing into three laminæ, of which the anterior, which is very thin, passes before the quadratus lumborum to be attached to the base of the transverse processes of the lumbar vertebræ. The middle lamina, which is thicker, glides behind this muscle, before the sacro-spinalis, to terminate at the summit of the same processes; while the third or posterior lamina, which is confounded with the aponeurosis of the obliquus internus, is inserted into the summits of the spinous processes of the loins.

From these different points of attachment, the fleshy fibres proceed horizontally forwards and inwards, towards the deepest lamina of the abdominal aponeurosis, (1102.) The middle fibres are the longest; the rest gradually decrease upwards and downwards. Some of the upper are inserted into the xiphoid cartilage.

1111. The fleshy portion of this muscle is covered *externally* by the obliquus internus, and, *internally*, covers the peritoneum.* Between the cartilages of the last three ribs, it is continuous with the diaphragm; and, near the ensiform cartilage, with the triangularis sterni. The spermatic cord simply glides under the *lower edge* of this muscle, without traversing its fibres, at about an inch from the place where it perforates the obliquus internus. Now, from what we have said of the connection of this cord with the three muscles of the abdomen, there results that the alleged *inguinal ring* is a true canal from two to three inches long, directed obliquely from the iliac region towards the pubes, of which the inner extremity corresponds to the point where the cord passes under the edge of the transversus abdominis, and the outer to the aperture of the lamina of the abdominal aponeurosis which belongs to the obliquus externus. Formed anteriorly by the ligament of Fallopius, posteriorly by the crest of the pubes, externally by the psoas magpsus and iliacus internus, and by the fascia iliaca, internally by Gimbernat's ligament, the upper orifice of this canal is rounded, covered by the peritoneum, closed by a cellular or ligamentous septum, and commonly perforated by several apertures for the lymphatic vessels of the thigh. The canal itself is formed *anteriorly* by the superficial lamina of the fascia lata; *posteriorly* and *internally* by the pectineus and the deep lamina of the femoral aponeurosis; in the same direction and *externally*, by the psoas and iliacus muscles and the fascia lata. Its inferior orifice has a very irregular spiral form, and corresponds to the inguinal ring, properly so called.

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* On the inner surface of the transversus muscle, and interposed betwixt it and the peritoneum, the student will observe the *fascia transversalis*. The anatomical relations of this fascia are most important; in it exists the opening by which the spermatic vessels pass from within the abdominal cavity, to be lodged in the inguinal canal previous to their passage through the external inguinal ring. The opening in the fascia has been called the internal ring, it being seated *deeper* than the other. But as the terms *external, internal,* are equivocal, it would be better to denominate the opening in the fascia transversalis the *ring of the fascia transversalis;* and to the opening in the abdominal aponeurosis, by which the spermatic vessels pass out, the name of the *ring of the external oblique muscle* might be given.—K.

1112. The transversus abdominis contracts the lower part of the belly, and brings forwards the ribs to which it is attached.

OF THE RECTUS ABDOMINIS.

1113. This is a long, flat, and pretty thick muscle, broader above than below, extended vertically, like a sort of fleshy band, on each side of the linea alba, from the pubes to the base of the thorax, and contained in a kind of fibrous sheath, formed by the two principal laminæ of the abdominal aponeurosis. The anterior lamina is, as we have said, composed of two laminæ above, and of three below. The posterior, which is entirely wanting below, has only two.

The rectus muscle arises by two tendons which are attached to the symphysis of the pubes, and rarely to the bone itself. One of these, the internal, is slender, and interlaced with that of the opposite side in the median line; the other, which is external, broader and stronger, comes from the outer part of the upper edge of the symphysis. Both ascend converging, and soon unite to give rise to the fleshy fibres. These ascend vertically towards the thorax, but are interrupted from space to space, in their passage, by aponeurotic intersections, whose number varies from three to five. There are always more of them above than below the umbilicus. When there are three, one is situated at the level of that cicatrix, and the other two above it; if there happen to be four, one of them is below it; lastly, if there are five, three are above and two beneath it. They are all transverse, and have a zig-zag direction; but their breadth and length are not the same. They frequently intersect the muscle only in a half or third of its breadth; their anterior part is much more distinct than the posterior, and adheres intimately to the lamina of the abdominal aponeurosis which forms the anterior wall of the sheath. They are also frequently oblique. We have still to remark that the muscular fibres which arise from an inferior intersection, do not all terminate in that which is placed immediately above, but that a great number of these fibres pass behind it without being interrupted, and pass on to a more remote intersection. There results, however, from such an arrangement, that these fibres are evidently much shorter than the muscle itself.

Arrived at the base of the thorax, the rectus abdominis divides into three portions, of which the inner, which is pretty thick, but having little breadth, is attached to the costo xiphoid ligament, and to the lower and fore part of the cartilage of the seventh rib, near the sternum; the middle, which is broader and thinner, is attached to the lower edge and anterior surface of the cartilage of the sixth rib, near its middle; and the outer, which is broader and thinner, terminates at the lower edge of the cartilage of the fifth, by very distinct aponeurotic fibres.

1114. The *anterior surface* of this muscle is covered above by the aponeurosis of the pectoralis major, and in the rest of its extent, by the anterior lamina of the abdominal aponeurosis, excepting at its lowest part, where the pyramidalis muscle is commonly met with. The *posterior surface* covers the cartilages of the last three true ribs, part of those of the first two false, the ensiform cartilage, the posterior lamina of the abdominal aponeurosis, the internal mammary and epigastric arteries, and inferiorly, the peritoneum.

1115. The rectus muscle bends the thorax upon the pelvis, or the pelvis upon the thorax. It compresses the abdomen from before backwards, &c.

OF THE PYRAMIDALIS.

1116. The *Pyramidalis* is a small elongated, rounded, triangular bundle, which does not always exist, and which is placed in the median line of the body, at the lower and fore part of the rectus. Sometimes there are two pyramidal muscles on each side; at other times this arrangement is met with only on one side. Frequently they are very short and indistinct; and sometimes they are of considerable dimensions. They also vary much in other respects. They arise from the symphysis of the pubes and from a little of the neighbouring part of the bone, by short aponeurotic fibres, which ascend converging toward each other, being only separated by the linea alba, in which they terminate by a slender and elongated tendon. The inner fibres are vertical and shorter than the outer, which are oblique.

1117. The pyramidalis is applied *posteriorly* upon the rectus, and is covered *anteriorly* by the abdominal aponeurosis.

1118. It appears to assist the rectus in its action, by fixing its tendon. It stretches the linea alba and abdominal aponeurosis.

2. *Lumbar Region.*

OF THE QUADRATUS LUMBORUM.

1119. This is a flat, pretty thick, irregularly quadrilateral muscle, situated in the loins, upon the sides of the vertebral column, and in the posterior wall of the abdomen. It is attached below, by aponeurotic fibres, and over an extent of about an inch, to the middle and posterior part of the iliac crest, as well as to the ilio-lumbar ligament, and by some transverse fibres, to the transverse process of the fifth lumbar vertebra. The fleshy fibres which come from the iliac bone ascend to the last rib and terminate in nearly the whole length of its inferior edge. Those which arise from the ligament, and which are so much the longer the more external they are, proceed upwards and inwards, and terminate in four aponeurotic slips, continuous at their edges, and attached to the fore part of the base of the first four transverse processes of the loins.

Frequently the aponeuroses at the commencement of the muscle are kept down inferiorly by other fibres arising from the fifth of these processes and directed transversely outwards. Frequently also, a distinct fleshy plane proceeds from the third or fourth of them, ascends outwards, and loses itself in the rest of the muscle.

1120. The *anterior surface* of the quadratus lumborum is covered above by the diaphragm, and, in the rest of its extent, by the anterior lamina of the aponeurosis of the transversus abdominis and by the psoas magnus. It corresponds to the kidney and colon by the intervention of other parts. Its *posterior surface* is separated from the sacro-spinalis by the middle lamina of the aponeurosis of the transversus abdominis.

1121. This muscle inclines the loins to one side; it lowers the last rib, and is subservient to exspiration, being an antagonist of the scaleni muscles in this respect. It can also raise the haunch.

MUSCLES OF THE EXTREMITIES.

I. MUSCLES OF THE SUPERIOR EXTREMITIES.

A. MUSCLES OF THE SHOULDER.

1. *Posterior Scapular Region.*

OF THE SUPRA-SPINATUS.

1122. The *supra-spinatus* is situated at the posterior and upper part of the shoulder. It is long, thick, triangular, pyramidal, broader within than without; and is kept in position by a very thin aponeurosis, which arising on the one hand from the whole length of the upper lip of the spine of the scapula, is attached on the other behind the upper edge of that bone and to the upper part of its inner edge. The fleshy fibres arise from the posterior part of this aponeurosis, and from the two inner thirds of the fossa supra-spinata by short aponeuroses. They proceed outwards, converge toward each other, and are inserted obliquely round a broad aponeurosis, which, after being long concealed among them, contracts, becomes thicker, and entirely emerges from them, passing under the coraco-acromial ligament. It then forms a strong tendon, more apparent internally than externally, almost always united to that of the infra-spinatus. Separated by the long portion of the biceps from that of the subscapularis, this tendon curves a little over the shoulder joint, becomes identified with its fibrous capsule, and is attached to the upper surface of the large tuberosity of the humerus.

1123. The *posterior surface* of this muscle is covered by the trapezius and deltoides, and by the coraco-acromial ligament. The *anterior* is applied upon the fossa supra-spinata; from which it is separated, in its outer third, by much cellular tissue, and by the superior scapular vessels and nerve. It also corresponds to the capsule of the shoulder joint, the omo-hyoideus muscle, and the coracoid ligament, (651.)

1124. It assists the deltoid muscle in raising the arm. If the arm is fixed, it acts upon the scapula.

OF THE INFRA-SPINATUS.

1125. This muscle is situated below the preceding, lying in the fossa observed on the posterior surface of the scapula beneath its spine. It is broad internally, narrow externally, thick and triangular, and is kept down posteriorly by a thin aponeurosis, which is prolonged below over the teres minor, to be inserted into a bony ridge between that muscle and the teres major, is attached above to the spine of the scapula, where it is continuous with the insertions of the trapezius and deltoides, and internally to the spinal edge of that bone, and at length loses itself externally upon the capsule of the shoulder-joint. Its fibres cross each other and are very apparent. Some of the fleshy fibres come from this aponeurosis internally; but the greater number arise from the two inner thirds of the fossa infra-spinata. Of these fibres, the upper proceed horizontally outwards, and the rest ascend more and are longer the lower their position is. They go to a broad aponeurosis concealed beneath them, situated nearer the posterior surface of the muscle than the anterior, and which, towards the humerus degenerates into a strong and thick tendon, which is attached to the middle surface of the large tuberosity of that bone, after being identified with the fibrous capsule of the articulation, and in part confounded with those of the supra-spinatus and teres minor.

1126. The *posterior surface* of this muscle is covered externally by the deltoid muscle, internally by the trapezius, below by the latissimus dorsi, in the middle by the integuments. The *anterior surface* covers the fossa infra-spinata, from which it is separated, in its outer third, by much cellular tissue, and by the superior scapular nerve and vessels. It is also applied upon the capsule of the shoulder joint. Its *lower edge*, which is inclined obliquely upwards and outwards, is connected internally with the teres major by an aponeurotic partition, which presently divides into two laminæ, one of which passes between the teres major and minor, the other between the infra-spinatus and teres minor. This edge is then confounded with the teres minor as far as the middle of its length.

1127. When the arm is lowered, the infra-spinatus turns it outwards by rotation. When it is raised, it draws it backwards.

OF THE TERES MINOR.

1128. The *Teres Minor* is a long narrow muscle, flattened from above downwards in its inner half, and from behind forwards in the outer. It is situated beneath the preceding, and arises from a rough triangular surface, which limits the fossa infra-spinata near the axillary edge of the scapula, and from two aponeurotic laminæ which separate it from the teres major and infra-spinatus. From thence, it ascends obliquely outwards, running along the infra-spinatus, to which it is often united. Its fleshy fibres terminate, near the humerus, on the anterior surface of a flat tendon which commences by aponeuroses on the posterior surface of the muscle, and which is inserted into the inferior surface of the great tuberosity, where it is united with the capsule of the joint. Some of the lower fibres are directly attached to the humerus, beneath the great tuberosity.

1129. Its *posterior side* is covered by the deltoid muscle and the skin. The *anterior* covers the external scapular artery, the long portion of the triceps, the fibrous capsule of the joint, and a small portion of the scapula. The *upper side* is broader internally than externally. It is connected, in the former direction with the infra-spinatus muscle. The *lower* is connected internally with the teres major, from which it is afterwards separated by the long portion of the triceps.

1130. The teres minor has the same uses as the infra-spinatus.

OF THE TERES MAJOR.

1131. The *Teres Major* is a long flat muscle, broader than the preceding, beneath which it is situated. It arises by short aponeurotic fibres, from a quadrilateral surface which terminates inferiorly the fossa infra-spinata, and from fibrous partitions that are met with between it and the subscapularis on the one hand, and the infra-spinatus and teres minor on the other. From thence its fleshy fibres, which are all parallel, proceed obliquely outwards running along the teres minor; then twisting upon themselves, separate from that muscle, and give rise to a broad and flat tendon, more distinct above than below, and before than behind. This tendon, which is about an inch broad, follows the direction of the muscle, is applied by its anterior surface upon that of the latissimus dorsi, (885) unites with it, and is attached to the posterior edge of the bicipital groove of the humerus, in the manner which we have already described.

1132. Its *posterior surface* is covered internally by the latissimus dorsi, and in the middle by the skin. Externally, it corresponds to the humerus and the long portion of the triceps. The *anterior surface* is in connection with the subscapularis, latissimus dorsi, coraco-brachialis and biceps muscles, and with the axillary vessels and brachial plexus. Its *lower edge*, which is covered by the integuments, forms with the latissimus dorsi the posterior edge of the hollow of the axilla. The *upper edge*, which is united to the teres minor internally, but separated from it in the middle by the long portion of the triceps, corresponds externally with the subscapularis muscle, and the circumflex vessels and nerve.

1133. This muscle rotates the humerus inwards. When its action is combined with that of the latissimus dorsi and pectoralis major, it applies the arm against the thorax. It is consequently an antagonist of the two preceding muscles.

1134. We have already several times made mention of the *axilla* or *arm-pit*, of which the teres major, as we have just said, forms the posterior edge. It is the angle or cavity that lies beneath the junction of the arm with the shoulder, and which is limited before by a portion of the pectoralis major, and behind by a part of the latissimus dorsi. The form of this cavity varies in the different positions of the arm. The skin by which it is lined is soft and delicate, covered with hairs, and attached to the adjacent parts by a loose filamentous laminar tissue, capable of great extension. It is filled with sebaceous follicles which furnish an excretion having a strong smell and more or less coloured. Beneath the skin, and in the midst of the adipose tissue, there are seen several lymphatic ganglia, nerves, and vessels, which it is of great importance to know.

2. *Anterior Scapular Region.*

OF THE SUBSCAPULARIS.

1135. The *Subscapularis* is a very thick triangular muscle, which occupies the whole of the subscapular fossa, from the three inferior fourths of which it arises, both from its periosteum, and from three or four aponeurotic partitions between the fleshy fibres, which are themselves attached to the oblique bony ridges presented by the scapula at this place. Some of its fleshy fibres also come from another aponeurotic septum placed between it and the preceding muscle. They are disposed into five or six distinct bundles which converge together, and proceed outwards, the upper horizontally, and the lower more and more obliquely. They are attached to the two surfaces of a broad and flat tendon, which appears to owe its first origin to the aponeurotic partitions of the muscle, contracts and becomes thicker, and terminates at the small tuberosity of the humerus by embracing it. This tendon adheres strongly to the capsule of the joint, which presents beneath it a true opening, (654) so as there to be in immediate contact with the synovial membrane of the articulation, above which there frequently occurs another smaller hole, which communicates with it. Some of the lower fibres of the muscle are attached directly to the humerus, beneath its small tuberosity.

1136. The *anterior surface* of the subscapularis, which is concave internally, and convex outwards, is separated from the serratus magnus, with which it forms the hollow of the axilla, by a very thick layer of cellular tissue (851.) Its outer part corresponds to the brachial plexus, axillary artery, and coraco-brachialis, biceps, and deltoid muscles. Its *posterior surface* covers the scapula, and beyond that bone it is in connection with the teres major and the long portion of the triceps brachialis. Farther on, it covers the capsule of the shoulder joint.

1137. When the arm is separated from the body, the subscapularis draws it toward it. When in its natural position, it can turn it inwards, and when raised, it depresses it. It also strengthens the articulation.

3. *External Scapular Region.*

OF THE DELTOIDES.

(*M. Sous-Acromio-Humeral.* Chauss.)

1138. The *Deltoides*, so named on account of its resembling the Greek letter Δ, forms what is called the top of the shoulder. It is thick, flat, triangular, broader above than below, curved upon itself to embrace the shoulder joint, whence it descends to the outer side of the arm, as far as its middle. It is composed of seven fleshy bundles, separated by grooves which are more or less deep according to the individual, and are divided into two orders. Those of the first order, to the number of four, are broad and fleshy above, contracted below, and terminate by strong tendons. One of them, which is strengthened behind by a transverse fibrous band which unites the acromio-coracoid ligament to the pectoralis major, arises from the outer third of the anterior edge of the clavicle, by small aponeuroses, and descends obliquely outwards. Another is inserted externally into the acromion by various aponeurotic fasciculi, which are more or less prolonged in or over the fleshy fibres. It descends vertically. The two last proceed from the posterior edge of the spine of the scapula, where they are attached by means of an aponeurosis which unites with those of the trapezius and infraspinatus, and are directed obliquely downwards and forwards. The bundles of the second order, to the number of three, are placed in the interval of these latter, between which they seem to ascend, to terminate in a point at the commencing aponeuroses. All these different bundles, which are themselves formed of fleshy fibres disposed in secondary bundles, are united below into a very strong triangular tendon, broad and thick, little apparent externally, but prolonged to a great length upon the inner surface of the muscle, where each bundle furnishes a portion to it, and attached to the deltoid impression of the humerus, over an extent of about an inch and a half. At its termination, it is embraced by a bifurcation of the brachialis internus (1150.)

1139. The *outer surface* of the deltoid muscle is convex, and covered by the skin and platysma myoides above. The *inner surface*, which is concave, is applied from behind forwards, and from above downwards, upon the infra-spinatus, teres minor, and triceps extensor muscles, the tendon of the supra-spinatus, the acromio-coracoid ligament, the sub-scapularis, pectoralis minor, biceps, and coraco-brachialis muscles, the coracoid process, the capsule of the joint, the upper third of the outer surface of the humerus, the circumflex nerve and vessels, and the tendon of the pectoralis major. Between the upper part of the deltoid muscle and the subjacent organs, the cellular tissue forms a sort of loose and very flexible membrane. The *posterior edge* of the muscle is very thin above, and very thick below. The *anterior* is separated above from the pectoralis major by a cellular interval occupied by the cephalic vein, (841); and below is parallel to the outer edge of the biceps.

1140. When the shoulder is fixed, the deltoid muscle raises the arm directly, or carries it at the same time forwards or backwards, according to the direction of the bundles which act. When the arm is raised, its posterior fibres can lower it. If the arm is fixed, it depresses the shoulder.

B. MUSCLES OF THE ARM.

1. *Anterior Brachial Region.*

OF THE CORACO-BRACHIALIS.

(*M. Coraco-Humeral.* Chauss.)

1141. This muscle is long, thin, flat, and narrow, especially at its extremities, and is situated at the upper and inner part of the arm. It arises from the summit of the coracoid process, between the short head of the biceps and the pectoralis minor, with which it is united. This origin takes place by means of an aponeurosis, which also belongs to the short portion of the biceps, is extended before their common fibres, is then interposed between the two muscles, and separates into two portions, one for each of them. It is from the posterior surface of this aponeurosis that the fleshy fibres arise. In their upper third they are confounded with those of the biceps, but are afterwards separated, and descend obliquely backwards and outwards, forming a bundle which increases in size to its middle part. When arrived near the humerus, they terminate in an aponeurosis, at first concealed among them, then appearing externally, more distinct within and above than below and without, and fixed to the middle part of the inner surface and edge of the humerus, between the brachialis internus and triceps. It is united to the latter muscle.

1142. The coraco-brachialis is traversed at its middle part by the musculo-cutaneous nerve, which, however, does not always happen. Its *anterior surface* is covered by the deltoid, pectoralis major and biceps. The *posterior* is applied upon the subscapularis muscle, the united tendons of the latissimus dorsi and teres major, the axillary artery, the musculo-cutaneous and median nerves, and the brachial artery.

1143. *Synovial Bursa.* There exists a synovial bursa between the fibrous capsule of the shoulder joint and the place of union of the short portion of the biceps and coraco-brachialis.

1144. It carries the arm forwards and inwards, and raises the humerus a little. When the latter bone is fixed, it turns the scapula by separating its lower angle from the chest.

OF THE BICEPS FLEXOR CUBITI.

1145. This muscle is situated at the fore and inner part of the arm. It is elongated, much broader and thicker at its middle part than at the extremities, and is divided above into two portions. The *outer* is longer, and arises from the upper part of the edge of the glenoid cavity of the scapula, by a very long, slender, flattened tendon, which results from the junction of the two branches of the glenoid rim, (656.) This tendon turns over the head of the humerus, becoming broader, crosses the articulation obliquely inwards, and advances to the interval between the two tuberosities, surrounded by a sheath which is furnished by the synovial capsule, (659.) It then becomes rounded, contracts, and enters the bicipital groove, still accompanied by the synovial membrane, and kept down by a prolongation of the fibrous capsule. Emerging from this groove, it continues to descend vertically, expands, and gives rise to fleshy fibres. The second or inner portion, which is shorter, is attached to the summit of the coracoid process, along with the coraco-brachialis muscle, as we have already said, (1142.) It descends a little outwards, approaching the other, and becomes fleshy much sooner than it.

1146. The two fleshy bundles of the muscle are fusiform, and are longer covered by the tendinous fibres externally than internally. They approach each other as they descend, soon come into contact, unite by a very thin cellular line, and are at length intimately confounded toward the lower third of the arm, sometimes higher and sometimes lower. The bundle which results from this junction continues to descend diminishing in size, and near the elbow joint is converted into a tendon which makes its appearance a little sooner on the outside than internally. At first broad and thin, it is in a great measure concealed by the fleshy fibres. When it has fairly emerged from them, it becomes narrower and rounded, turns obliquely outwards, and furnishes by its inner edge a pretty broad fibrous prolongation, which proceeds downwards and inwards to join the aponeurosis of the fore-arm, before the brachial artery and the pronator teres. It then sinks between the supinator longus and pronator teres, and on arriving beneath the elbow, twists upon itself to terminate by embracing the bicipital tuberosity of the radius, at its back part.

1147. The *anterior surface* of the biceps is covered above by the deltoid and pectoralis major; in the rest of its extent, by the brachial aponeurosis and the integuments. The *posterior surface* rests upon the humerus, the coraco-brachialis and brachialis internus muscles, and the musculo-cutaneous nerve. Its *inner edge* is united above with the coraco-brachialis; in the middle and below, it is coasted by the brachial artery.

1148. *Synovial Bursa.* A thin, very loose synovial capsule, generally containing a good deal of the moisture, invests the outer surface of its lower tendon, the fore part of the bicipital process and of the neck of the radius, is engaged in a notch of the circumference of the supinator brevis, and contributes much to facilitate the motions of the muscle.

1149. The biceps flexor bends the fore-arm on the arm, turns the hand forwards when the palm is directed backwards, or bends the arm upon the fore-arm when the latter is fixed. Lastly, it may bring the humerus and scapula closer together, and strengthens the shoulder joint by means of the tendon of its long portion.

OF THE BRACHIALIS INTERNUS.

1150. This muscle is deeply seated at the lower and fore part of the arm, before the elbow-joint. It is flat, broader in the middle and at its upper part than below. It arises from the outer and inner surfaces of the humerus, over a space extending from the deltoid impression to near the elbow-joint, and is also attached along the inner edge of that bone, to an aponeurotic partition which separates it from the triceps extensor, and along its outer edge close to the supinator longus. From these origins it descends nearly vertically, increases to its middle part, then becomes a little thinner, passes obliquely inwards over the elbow-joint, and terminates at the rough impression observed beneath the coronoid process of the ulna, by a broad and thick tendon, which commences by several portions at a considerable distance above the joint, in the substance of the muscle, especially on the outer side, and sends some fibres to the aponeurosis of the fore-arm. The middle fibres of this muscle are vertical, and longer than the inner or outer, which are directed obliquely outwards and inwards. All the fibres, moreover, are shorter in proportion to their depth.

1151. Its *anterior surface* is covered above by the brachial aponeurosis and the skin, below and externally, by the supinator longus, which is lodged in a depression which it presents; at the middle, by the biceps muscle and the musculo-cutaneous nerve; internally, by the brachial artery, the median nerve and the pronator teres. The *posterior surface* covers the lower part of the humerus, and its articulation with the bones of the fore-arm. Its *upper extremity* presents a notch which embraces the tendon of the deltoid muscle. (1139.)

1152. This muscle bends the fore-arm upon the arm, or the latter upon the former.

2. *Posterior Brachial Region.*

OF THE TRICEPS EXTENSOR.

1153. This muscle, which occupies the posterior part of the arm, is elongated, flat, thicker in the middle than at its extremities, and divided at its upper part into three portions. Of these, the middle, which is longer and larger than the others, arises from the highest part of the outer edge of the scapula, over an extent of about an inch, immediately under the glenoid cavity, by a flat tendon, which separates into two aponeuroses, an outer and shorter, and an inner, which extends much farther downwards. The fleshy fibres of this portion of the muscle, arising from the outer and back part of the tendon just mentioned, form a bundle, which, at first flat and thin, descends vertically between the teres major and teres minor, behind the shoulder joint, then increases in size, and is united to the outer portion about a third down the arm, and to the inner about its middle.

The outer portion, which is not so long or so thick as the middle, and is broader below than above, arises, by a pointed extremity, from the upper part of the outer edge of the humerus, beneath the great tuberosity of that bone. Its fleshy fibres, which descend obliquely backwards and inwards, and are so much the shorter the lower they are, come moreover from the outer edge of the humerus over a larger extent, and from an aponeurotic partition which is common to them with those of the deltoid muscle and brachialis internus.

The inner portion, which is shorter than the outer, but of the same form, commences under the tendon of the teres major and latissimus dorsi by a sharp and elongated extremity, which is attached to the inner edge of the humerus, and receives additions in succession from an aponeurosis which covers it above, from the posterior surface of the humerus, and from a fibrous partition which separates it from the brachialis internus. Its fleshy fibres descend backwards and outwards.

1154. After their union, these three portions of the muscle form a thick and broad bundle, concave before for embracing the humerus, and terminate by a very strong tendon, also broad and thick, which is attached to the posterior and upper part of the olecranon, over a considerable extent of surface. This tendon commences by two aponeuroses. The outer, broad and thin, with longitudinal and parallel fibres, arises behind the muscle, towards its middle part, and sends downwards a fibrous prolongation to the aponeurosis of the fore-arm. The inner, which is narrower but broader, descends in the substance of the muscle from the point of junction of its three portions, after having even extended for some time along the anterior surface of the lower part of the middle portion.

1155. Besides the fleshy fibres which are furnished to it by each of the three portions, the common bundle receives a great number of others which arise along the lower third of the posterior surface of the humerus, to near the olecranal cavity, and descend obliquely backwards upon the anterior surface of the tendon. The *outer* side of the tendon and of its aponeurotic origins serves for the insertion of several others which come from about the lower fourth of the outer edge of the humerus, where they leave between them a small aperture for the passage of the radial nerve and its accompanying vessels, and which appear to form a particular muscle separated from the rest of the outer portion by a line of cellular tissue. They are short, have little obliquity, and are even transverse below, where they are parallel to the superior fibres of the anconeus. Lastly, at its inner part, this same tendon is also furnished with fleshy fibres which come from the lowest part of the inner edge of the humerus.

1156. The *posterior surface* of the triceps extensor is convex, and covered above by the teres minor and deltoid, and in the rest of its extent, by the brachial aponeurosis and the skin. The *anterior surface* covers the sub-scapularis, teres major and latissimus dorsi, above. It is united to the fibrous capsule of the shoulder joint by cellular tissue. At its lower part, it is in connection with the posterior surface of the humerus, to which it is attached, excepting at the place where the radial nerve and the collateral vessels pass. Lastly, at its lowest part, it is applied upon the posterior part of the elbow joint.

1157. The triceps extensor acts in opposition to the biceps and brachialis internus, extending the fore-arm upon the arm, and in certain circumstances, the arm upon the fore-arm. When the fore-arm is extended, its long portion carries the arm backwards. It may also sometimes move the scapula upon the humerus.

C. MUSCLES OF THE FORE-ARM.

1. *Anterior and Superior Region of the Fore-arm.*

OF THE PRONATOR TERES.

1158. This muscle is extended obliquely at the upper and anterior part of the fore-arm. It is rather short, broad at its commencement, then thicker, and at last obviously contracted, but still broader than thick. It arises from the inner condyle by a tendon which is common to it with the flexor carpi radialis, palmaris longus, flexor carpi ulnaris and flexor digitorum sublimis; from the coronoid process by another small distinct tendon, which permits the radial nerve to pass between it and the first; from an aponeurotic septum which separates it internally from the flexor carpi radialis; from a similar partition placed between it and the flexor sublimis, and lastly, from the aponeurosis of the fore-arm. Its fleshy fibres, which are all parallel, descend from thence obliquely outwards, to the middle of the outer surface of the radius, where they are attached by means of a broad and thick tendon, at first concealed in their substance, and afterwards expanded in the form of a membrane over their anterior surface.

1159. The *anterior surface* of this muscle is covered, in its two upper thirds, by the aponeurosis of the fore-arm and by the skin; in the lower third, by the supinator longus, the radial nerve and vessels, and the radial extensor muscles. The *posterior surface* covers the brachialis internus and flexor sublimis muscles, as well as the median nerve and ulnar artery. Its *outer edge* is separated above from the supinator longus by a triangular space in which are lodged the tendon of the biceps, the brachial artery and the median nerve. Inferiorly, it is parallel to the anterior edge of the supinator brevis, which it covers a little.

1160. The pronator teres turns the radius upon the ulna from without inwards, and thus turns the palm of the hand backwards. If the radius is kept back by the supinator muscles, it can bend the fore-arm upon the arm, or the latter upon the former.

OF THE FLEXOR CARPI RADIALIS.

1161. This muscle, which is long, fusiform, thick and fleshy above, thin and tendinous below, is situated internally of the pronator teres. It arises above from the inner condyle by the common tendon of which we have spoken (1158); anteriorly, from the aponeurosis of the fore-arm; posteriorly, from an aponeurotic septum which separates it from the flexor sublimis, and which afterwards descends some way upon its posterior surface; externally and internally, from two similar partitions which separate it, in these two directions, from the pronator teres and palmaris longus. Its fibres form a bundle, which is large in the middle and slender at its extremities. They descend a little outwards, and near the upper third of the fore-arm, terminate upon a tendon, which at first concealed among them, afterwards separates, descends in the original direction of the muscle, passes before the wrist-joint, then enters, behind the abductor and opponens pollicis, a groove of the trapezium, in which it is retained by a ligamentous sheath and by a small prolongation of its own fibres, and at length, sinking backwards and outwards, is attached to the fore part of the upper extremity of the second metacarpal bone, becoming broader at its insertion. This tendon, which is narrow and round below, is broad and thin above, and is sooner separated from the fleshy fibres anteriorly than at its back part.

1162. The *anterior surface* of the flexor carpi radialis is covered externally by the supinator longus, and in the rest of its extent, by the aponeurosis of the fore-arm. The *posterior* is applied upon the flexor digitorum perforatus and flexor longus pollicis muscles, and upon the wrist joint. Its two edges are connected above with the pronator teres and palmaris brevis.

1163. *Synovial Bursa.* The fibrous sheath which keeps its tendon in the groove of the trapezium seems to come from the extremity of the radius, from the aponeurosis of the fore-arm, and from the outer edge of the groove. It is attached to the inner edge of the latter, to the trapezoides and second metacarpal bone, where it is continuous with the insertions of the neighbouring muscles. This sheath contains an elongated synovial membrane which is reflected over the tendon, and frequently rises above it.

1164. This muscle bends the hand upon the fore-arm, turning it a little inwards. When the hand is fixed it bends the fore-arm upon it.

OF THE PALMARIS LONGUS.

1165. This muscle is often wanting in one or other arm, sometimes in both. It has the same form as the preceding, internally of which it is situated, only it is thinner and more slender. It arises above from the inner condyle by the common tendon; behind, externally and internally, from aponeurotic partitions which that tendon sends between it and the flexor perforatus and flexor carpi radialis; anteriorly, from the aponeurosis of the fore-arm. The small bundle formed by its fleshy fibres descends vertically along the middle part of the fore-arm, and is terminated by a thin, flat, very slender and very elongated tendon,* which loses itself in the upper part of the palmar aponeurosis, after sending some fibres to the anterior annular ligament of the wrist.

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* The form of this muscle is sometimes different, commencing by a long and slender tendon and terminating by a fleshy belly. K.

1166. Its *anterior surface* is covered by the aponeurosis of the fore-arm. The *posterior* covers the flexor perforatus. Its two edges are united above, the one with the flexor carpi radialis, the other with the flexor perforatus.

1167. It stretches the palmar aponeurosis, and bends the hand on the fore-arm, or the fore-arm on the hand.

OF THE FLEXOR CARPI ULNARIS.

1168. Situated internally of the preceding muscles, at the fore part of the inner edge of the fore-arm, long, thin, flat, semi-penniform (793), broader above than below, this muscle arises from the inner condyle, by means of the common tendon, and from the inner side of the olecranon. Between these two origins passes the ulnar nerve, covered by an aponeurosis which goes from the one to the other. It also takes origin, externally, from a short aponeurotic septum which separates it from the flexor perforatus; internally, from the aponeurosis of the fore-arm, which presents for this attachment very distinct and strong fibres, which proceed to the posterior edge of the ulna, and there fix the muscle over a great extent. From these different points the fleshy fibres descend, the outer nearly vertically, the inner obliquely forwards and outwards. The first terminate at the upper extremity, the others along the whole posterior surface of a tendon which runs for a long time upon the inner and fore part of the muscle, after being at first concealed in its substance. This tendon becomes free only at the lower part of the fore-arm, and is inserted into the pisiform bone, becoming a little broader. At the moment of its termination, some fibres are detached from it, of which one set descends before the abductor and flexor pollicis, while the others pass before the ulnar artery, to be continued into the upper part of the anterior annular ligament of the wrist.

1169. The *anterior surface* of this muscle is covered by the aponeurosis of the fore-arm; the *posterior* covers the flexor perforans, the ulnar artery and nerve, and the pronator quadratus. Its *outer edge* is united above with the flexor perforatus, from which it is separated below by an interval in which the ulnar nerve and vessels are seen.

1170. It bends the hand upon the fore-arm, inclining it a little towards the ulna. When it contracts at the same time with the extensor carpi ulnaris, it draws it directly towards the mesial line.

OF THE FLEXOR DIGITORUM SUBLIMIS OR PERFORATUS.

1171. This muscle is elongated, very thick and flattened, and is situated on the fore-arm between the preceding muscles and the flexor perforans. It is simple above, but separates into four tendons below. It arises from the inner condyle, by means of the common tendon; from the internal lateral ligament of the elbow joint, and from the coronoid process of the ulna, by pretty long aponeuroses; from two aponeurotic partitions which exist between it and the flexor carpi ulnaris internally, and the pronator longus, palmaris longus, and flexor carpi radialis, anteriorly. From these different points there proceeds a rather thin fleshy bundle, which descends a little obliquely outwards, and receives another broad, thin, and flat muscular plane, which comes from the anterior edge of the radius, where it is attached by very distinct aponeurotic fibres, between the supinator brevis and flexor longus pollicis. The muscle then increases in breadth and thickness, and is frequently still more augmented by another portion which arises separately from the inner condyle. It descends vertically, and soon divides into four portions, which proceed, one to each of the last four fingers. Two are anterior, united to each other by their edges, and belong to the middle and ring fingers; two posterior, one for the fore finger, the other for the little finger. The latter is the smallest, while that of the middle finger is the broadest and thickest. They are all terminated by tendons proportioned to their size, which are connected together, and with those of the flexor perforans by loose cellular tissue.

1172. Each of these tendons commences very high upon the fleshy portion to which it corresponds. That of the middle finger extends along its outer and posterior side, and receives the fibres which arise from a part of the common tendon and from the anterior edge of the radius. It is accompanied by them until close to the anterior annular ligament of the carpus. That of the ring finger, which is at first concealed in the substance of its fleshy portion, afterwards appears at its fore part, but pretty low, and receives the fibres of a part of the common tendon and of the aponeurotic septum which separates the flexor perforatus from the flexor carpi ulnaris. The tendon of the little finger also commences very high on the anterior surface of its fleshy portion, which comes from a tendinous intersection placed in the substance of the muscle, like that of the fore-finger; but the latter descends much farther on the tendon.

1173. These four tendons pass into the groove which the anterior surface of the carpus presents, and are there kept down by the annular ligament, beneath which they separate from each other to descend, in the palm, behind the palmar aponeurosis, and before the tendon of the flexor perforans and the lumbricales. They then enlarge a little, are enveloped by a loose cellular sheath, are engaged toward the heads of the metacarpal bones, between partitions formed by the palmar aponeurosis, and are lodged in a groove which the anterior surface of the phalanges presents, in which they are retained by a peculiar fibrous sheath.

Before arriving at these sheaths, the tendons exhibit the appearance of a middle longitudinal division, and present posteriorly a sort of concave channel, which receives the corresponding tendons of the flexor profundus; but, towards the lower part of the first phalanges, they actually split in the middle to afford a passage to these latter, and divide into two portions, which separate at first, then turn and approach each other, so as to form anteriorly a second channel which is filled by the tendon of one of the portions of the flexor profundus. These two portions unite towards the articulation of the first and second phalanges, and send off to each other small fibrous bands which regularly cross each other. Lastly, they separate again, contract and terminate on the sides of the anterior surface of the second phalanx, a little beneath its middle part.

At the moment of their first separation, these portions are attached to the anterior surface of the metacarpal phalanges by two pretty long and very slender ligamentous bridles. Sometimes there is only one.

1174. *Synovial Bursa of the carpus.* It is spread out, on the one hand, upon the tendons of the two common flexors of the fingers, and of the flexor longus pollicis, and upon the median nerve, which it embraces and seems to unite into a common bundle; and, on the other hand, upon the anterior surface of the carpal bones and the posterior surface of the annular ligament, above and below which it forms a sort of cul-de-sac. It sends a considerable number of replications between these different parts, and contains very little synovia.

1175. *Fibrous sheaths of the Fingers.* The sheaths which we have just mentioned, form with the anterior surface of the phalanges, a true canal, half bony and half fibrous, which lodges the tendons of each of the portions of the two flexor muscles. They commence beneath the inferior metacarpal ligament (699), from which several fibres are sent off to join them, and terminate at the extreme phalanx by interlacing with the expansion of the tendon of the flexor profundus, being in their whole extent attached along the edges of the phalanges. Their *anterior surface* is covered by the skin and collateral vessels of the fingers; the *posterior* is smooth and lined by a synovial membrane. The tissue of these sheaths is very compact. They are formed of interlaced transverse fibres, of a pearly colour, and are very thick at the middle of the first and second phalanges, but opposite their articulation, disappear entirely, so as to leave the synovial membrane exposed. The latter proceeds from the wall of the sheaths over the tendons, forming above and below very distinct culs-de-sac, and enveloping these tendons in a double web, which is fixed posteriorly against the phalanges by a triangular replication formed of two laminæ placed back to back. This separation which exists between the two terminal slips of the tendons of the flexor perforatus is filled by prolongations of the synovial membrane.

1176. The *anterior surface* of the flexor perforatus is covered by the pronator teres, flexor carpi radialis, and palmaris longus, the aponeurosis of the fore-arm, the annular ligament, the palmar aponeurosis, the fibrous sheaths of the fingers, and lastly, by the tendons of the flexor profundus. Its *posterior surface* covers the flexor profundus, the flexor longus pollicis, the median nerve, the ulnar artery, the lumbricales muscles, and the phalanges.

1177. This muscle bends the second phalanges upon the first, the latter upon the metacarpal bones, and lastly, the hand upon the fore-arm. It can also move the fore-arm upon the hand.

2. *Anterior and Deep Region of the Fore-arm.*

OF THE FLEXOR DIGITORUM PROFUNDUS OR PERFORANS.

1178. This is a thick, flattened, elongated muscle, bent upon itself so as to embrace the ulna, simple and fleshy above, separated into four tendons below. It arises from the three upper fourths of the anterior surface of the ulna, and from the interosseous ligament, from the impression which is observed below the coronoid process, where it bifurcates so as to surround the insertion of the brachialis internus (1150) sending at the same time a prolongation over the sides of the olecranon. It also arises from the aponeurosis which goes from the flexor carpi ulnaris to the ulna, and from the upper third of the inner surface of that bone. From these different origins, which are all aponeurotic, the muscle, thin at first, thicker in the middle, and becoming thin again, descends vertically, and divides into four portions, of which the three inner are not very distinct from each other. Each of these portions is terminated by a tendon, at first very broad, and separated into several slips concealed in the substance of the fleshy fibres, and appearing upon their anterior surface toward the middle of the fore-arm. These tendons do not become free until near the annular ligament, under which they pass along with those of the flexor sublimis, into the palm, where they descend, separating from each other. At first round and giving rise to the lumbricales, they become broader towards the articulations of the first phalanges with the metacarpal bones, present traces of a longitudinal division, are engaged in the fibrous sheaths of the fingers, pass through the fissure in the tendon of the flexor sublimis, lodged in the channels which limit it above and below, and are at length inserted into the fore part of the third phalanges of the last four fingers, after being enveloped by the synovial membrane of the fibrous sheaths.

1179. The *anterior surface* of this muscle is covered by the flexor sublimis and flexor carpi ulnaris muscles, the median and ulnar nerves, and the ulnar artery. The *posterior surface* is applied upon the fore and inner surfaces of the ulna, the interosseous ligament, the pronator quadratus, the anterior radio-carpal ligaments, the fore part of the metacarpus, the flexor brevis and adductor pollicis, and the last two palmar interossei muscles. Its *outer edge* corresponds above to the anterior interosseous artery.

1180. This muscle bends the third phalanges upon the second, the latter upon the first, the first upon the metacarpus, and the hand upon the fore-arm, or the fore-arm upon the hand.

OF THE FLEXOR LONGUS POLLICIS MANUS.

1181. This muscle is elongated, thin, flattened, thicker internally than externally, and situated upon the radius, from the three upper fourths of which it arises by short aponeurotic fibres, as well as from the neighbouring portion of the interosseous ligament, and even frequently from the coronoid process of the ulna, by a particular prolongation, fleshy in the middle, and tendinous at its extremities. The fleshy fibres, which are all oblique and about an inch long, form a bundle which descends nearly vertically, and are inserted at the back part of a tendon which they accompany until opposite the pronator quadratus. This tendon then becomes free and rounded, passes before the carpus, under the annular ligament, with the tendons of the two preceding muscles. It is there kept down by the synovial membrane which belongs to them (1174) and afterwards descends obliquely outwards between the two portions of the flexor brevis pollicis, then between the two sesamoid bones. It then passes into a fibrous sheath similar to that which we have described in the other fingers (1175), but whose fibres are very widely set and much larger. It is there invested by a synovial membrane which keeps it in place, presents the trace of a longitudinal division, and terminates by being expanded over the anterior surface of the last phalanx of the thumb.

1182. The *anterior surface* of the flexor longus pollicis is covered by the flexor digitorum sublimis, flexor carpi radialis and supinator longus muscles, the radial artery, and the anterior annular ligament of the wrist. The *posterior surface* lies upon the radius, part of the interosseous ligament, the pronator quadratus, the wrist joint, the fore part of the carpus, and the flexor brevis pollicis. Its *inner edge*, which is much thicker than the outer, lies upon the flexor digitorum profundus.

1183. This muscle bends the last phalanx of the thumb upon the first, the first upon the corresponding metacarpal bone, and the latter upon the radius. It can also bend the hand upon the fore-arm and the fore-arm upon the hand.

OF THE PRONATOR QUADRATUS.

(*M. Cubito-Radial.* Chauss.)

1184. The *pronator quadratus* is, as its name implies, of a quadrilateral form, thin and flat. It lies upon the lower part of the fore-arm, and arises by a very thin aponeurosis expanded over its inner third, from the lower fourth of the anterior edge of the ulna and the corresponding part of the anterior surface of that bone. From thence it is directed transversely outwards, and terminates at the fore part of the lower fourth of the radius by indistinct aponeuroses. Its fibres are so much the longer the more superficial they are. Its *anterior surface* is covered by the flexor digitorum profundus, flexor longus pollicis, flexor carpi radialis, and flexor carpi ulnaris muscles, and by the radial and ulnar arteries. The *posterior surface* covers the two bones of the fore-arm and the lower part of the interosseous ligament.

1185. It turns the radius upon its axis from without inwards, and thus induces pronation of the hand.

3. *Posterior and Superficial Region of the Fore-arm.*

OF THE EXTENSOR DIGITORUM COMMUNIS.

1186. This muscle, which is long, round, fleshy and simple at its upper part, terminating below in four tendons, arises above by a tendon which is common to it and the other three muscles of the same region, between which it sends prolongations, and which comes from the outer condyle; internally, from a long aponeurotic partition sent off from that tendon, and which separates it from the extensor proprius minimi digiti; externally, from a shorter partition placed between it and the extensor carpi radialis brevior; posteriorly, from the aponeurosis of the fore-arm. From these different origins, its fleshy fibres proceeding obliquely, form a bundle, at first thin, then thicker, and afterwards thin again, which descends vertically, and at the middle of the posterior surface of the fore-arm divides into four portions at first united by cellular tissue, and terminated each by a tendon at first concealed in their substance, and accompanied by the fleshy fibres to near the wrist, particularly in those of the ring finger and little finger. These four tendons are placed beside each other and are connected by a kind of soft and loose cellular membrane. They vary in size. That of the ring finger is the strongest and thickest; the next is that of the middle finger, and the little finger has the smallest. They pass along with the tendon of the extensor indicis in a groove which is formed behind the carpal extremity of the radius, where they are kept down by the posterior annular ligament. Beneath this ligament, the tendons diverge, become broader, and proceed to the base of the metacarpal bones. The last three are commonly longitudinally slit, and send small aponeurotic bands, varying in size, and more or less oblique, to each other. Opposite the articulations of the metacarpal bones with the phalanges, they contract and become thicker. They then enlarge anew, and receive the tendons of the lumbricales and interossei, forming with them an aponeurosis which covers the whole posterior surface of the fingers. Towards their extremity, they divide into three portions, of which the middle passes behind the articulation of the first and second phalanges to be inserted into the posterior surface of the latter, while the two lateral pass over the sides of the same articulation, contracting and separating from each other. They then approach each other and unite, forming a flat tendon which is attached to the posterior and upper part of the last phalanx.

1187. The *posterior surface* of this muscle is covered by the aponeurosis of the fore-arm, with which it is intimately united. The *anterior* covers the supinator brevis, extensores pollicis, extensor indicis, the wrist joint, the posterior surface of the carpus, metacarpus and fingers, and the interossei dorsales. Between its *outer edge* and the extensor carpi radialis brevior, is an interval in which are seen the extensor ossis metacarpi and extensor primi internodii pollicis.

1188. *Synovial Bursa.* As they pass under the annular ligament, the tendons of the extensor communis digitorum are embraced by a synovial membrane, but sparingly moistened, which sends several prolongations between them.

1189. This muscle extends the phalanges of the last four fingers upon each other, and upon the metacarpal bones, the hand upon the fore-arm, or the fore-arm upon the hand.

OF THE EXTENSOR PROPRIUS MINIMI DIGITI.

1190. This muscle is situated to the outside of the preceding, and is as long as it, but extremely slender. It arises from the outer condyle by the common tendon (1186), from the aponeurotic septum which separates it from the preceding muscle, from that which is placed between it and the extensor carpi ulnaris, and from the aponeurosis of the fore-arm. Its fleshy fibres constitute a small fusiform bundle which descends from without inwards, and pass very obliquely to within a short distance of the carpus to the anterior surface of a tendon at first concealed in their substance, and entirely free near the posterior annular ligament, which presents a fibrous canal for it, opposite the lower articulation of the radius and ulna, directed obliquely downwards and inwards, lined by a synovial capsule, and about two inches in length. Before passing into this canal, the tendon of the muscle divides into two portions, which remain contiguous and connected by cellular tissue; but towards the upper part of the metacarpus, it becomes single again and enlarges. It then arrives at the little finger, to the phalanges of which it is attached precisely in the same manner as those of the extensor communis, and is even united to the fourth tendon of that muscle by its outer edge.

1191. The *posterior surface* of this muscle is covered by the aponeurosis of the fore-arm, and is firmly attached to it above, At the back of the hand, it lies immediately under the skin. The *anterior surface* is applied upon the supinator brevis, extensores pollicis, and extensor indicis. Its *outer edge* is united above to the extensor digitorum communis; the *inner* to the extensor carpi ulnaris.

1192. Conjointly with the fourth portion of the preceding muscle, this extends the little finger, and even the hand upon the fore-arm.

OF THE EXTENSOR CARPI ULNARIS, OR ULNARIS EXTERNUS.

1193. The extensor carpi ulnaris is a long fusiform muscle, situated internally of the back part of the fore-arm. It arises from the outer condyle by the common tendon, which sends a very long prolongation over its anterior surface, from the aponeurotic septum placed externally between it and the extensor minimi digiti, from the aponeurosis of the fore-arm, and from about the middle third of the posterior edge of the ulna, below the anconeus muscle. From thence it descends at first a little obliquely inwards, and then vertically behind the ulna, and presently degenerates into a tendon sooner apparent behind than before, and concealed for some time in the fleshy fibres, which terminate upon it in the order of their origin, and accompany it to near the lower extremity of the bone, where it is engaged in a particular groove, under the posterior annular ligament. It passes behind the pyramidal bone, in a sort of fibrous canal, attached to that bone, the pisiform bone, the os unciforme, and the styloid process of the ulna, and lined by a synovial membrane scantily moistened. It passes under the abductor minimi digiti, enlarges a little, and terminates at the inner and back part of the upper extremity of the fifth metacarpal bone, whence it sends some aponeurotic fibres over the opponens minimi digiti.

1194. The *posterior surface* of this muscle is covered by the aponeurosis of the fore-arm, to which it adheres above. The *anterior* is applied upon the supinator brevis, extensor ossis metacarpi, and extensor secundi internodii pollicis, and extensor proprius indicis muscles, and upon the ulna. Its *outer edge* is united above to the extensor proprius minimi digiti; the *inner* is contiguous at its upper part to the anconeus.

1195. This muscle extends the hand upon the fore-arm, inclining it a little upon the ulna.

OF THE ANCONEUS.*

1196. This a short, rather thick, triangular muscle, frequently confounded with the triceps extensor (1155), and placed behind the elbow joint. It arises from the outer condyle by a distinct tendon, broader and thinner below than above, and descending pretty far upon the outer edge of the muscle. The fleshy fibres arise from this tendon, and follow different directions. The upper, which are very short, and continuous with those of the triceps, are nearly transverse, and terminate by short aponeuroses at the outside of the olecranon. The others, which are longer and more oblique the lower their position is, are inserted also by short aponeuroses into the upper fourth of the posterior edge of the ulna, and form pretty sharp points below.

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* A'γκῶν, *cubitus*, the elbow.

1197. The *posterior surface* of the anconeus is merely covered by the aponeurosis of the fore-arm, without adhering to it. The *anterior* is applied upon the articulation of the fore-arm, the annular ligament of the radius (668), the supinator brevis and the ulna.

1198. It contributes to the extension of the fore-arm upon the arm, or to that of the latter upon the former.

4. *Posterior and Deep Region of the Fore-arm.*

OF THE EXTENSOR OSSIS METACARPI POLLICIS.

1199. This muscle lies obliquely at the back and outer part of the fore-arm. It is long, slender, and flat, broader in the middle than at its extremities. It arises by a pointed extremity from the posterior surface of the ulna, beneath the supinator brevis, with which it is almost always united; then by short aponeurotic fibres, from a longitudinal ridge which is observed upon the posterior surface of that bone; and lastly, from a line directed obliquely downwards and outwards, which the posterior surface of the radius presents at its upper part, and from the interosseous ligament. Its fleshy fibres constitute a fusiform bundle which descends obliquely outwards behind the fore-arm, and terminate upon the posterior surface of a tendon which is at first concealed among them, and which they accompany to the inferior extremity of the radius. There, this tendon passes into a groove formed on the outer side of the extremity in question, and which is common to it and the extensor primi internodii pollicis. It is kept down by the anterior annular ligament of the wrist, and its motions are facilitated by a synovial membrane. This membrane commonly belongs also to the extensor primi internodii pollicis, but sometimes a fibrous partition separates the two tendons. On issuing from this groove, the tendon divides into two or three portions, and goes to be inserted into the outer part of the superior extremity of the first metacarpal bone, occasionally sending a small prolongation to the abductor pollicis.

1200. The *posterior surface* of this muscle is covered by the supinator brevis, extensor carpi ulnaris, extensor minimi digiti, extensor communis digitorum, and extensor secundi internodii pollicis, to which latter it is united. At its lowest part, it is in connection with the aponeurosis of the fore-arm. Its *anterior surface* covers a small portion of the ulna above; the interosseous ligament and the posterior surface of the radius, in the middle; the outer surface of that bone, the tendons of the radial extensors, the radial artery, and the wrist joint below.

1201. It carries the thumb outwards and backwards, and has the same action upon the hand. It may also contribute to supination.

OF THE EXTENSOR PRIMI INTERNODII POLLICIS MANUS.

1202. Much shorter and thinner than the preceding, but of a similar form, this muscle arises beneath it, from a small portion of the ulna, from the interosseous ligament, and more especially from the posterior surface of the radius. Following the same direction, it degenerates, on the outer side of the fore-arm, into a slender tendon, more apparent externally than internally, and which passes into a groove of the radius (1199) already described. On issuing from this groove, it separates from the extensor ossis metacarpi pollicis, descends behind the first metacarpal bone, becomes flattened, and is inserted at the upper and back part of the first phalanx of the thumb.

1203. Its *posterior surface* is covered by the extensor secundi internodii pollicis, extensor minimi digiti, and extensor communis digitorum. At its lower part, it is in connection with the aponeurosis of the fore-arm. Its *anterior surface* has the same connections as those of the preceding muscle (1200), excepting below, where it is applied upon the first metacarpal bone and its articulation with the thumb.

1204. It extends the first phalanx of the thumb upon the first metacarpal bone, and may afterwards draw the latter backwards and outwards. It also contributes to the supination of the hand.

OF THE EXTENSOR SECUNDI INTERNODII POLLICIS MANUS.

1205. This muscle is elongated, flat, fusiform, longer and larger than the preceding, and situated beneath it. It arises from about the middle third of the posterior surface of the ulna, and from a small portion of the interosseous ligament. It descends outwards, and terminates in a tendon which first appears behind, and which is isolated near the lower extremity of the radius, where it passes under the annular ligament, in a groove directed obliquely like itself, and lined by a synovial membrane. When it has arrived at the back of the hand, it becomes a little broader, passes under the tendons of the radial extensors, crosses their direction, descends at the posterior and inner part of the first metacarpal bone, joins the tendon of the extensor primi internodii pollicis near the articulation of that bone with the first phalanx, receives in the same place two aponeurotic expansions from the abductor and flexor brevis pollicis, becomes thicker, then enlarges a second time, and is inserted at the back part of the last phalanx of the thumb.

1206. Its *posterior surface* is covered by the extensor carpi ulnaris, extensor minimi digiti, extensor communis digitorum, and extensor indicis, and at its lowest part by the skin. The *anterior surface* lies upon the extensor ossis metacarpi pollicis and extensor primi internodii pollicis, the two bones of the fore-arm, the tendons of the radial extensors, the first metacarpal bone, and the phalanges of the thumb. Its *upper extremity* is frequently united with that of the extensor ossis metacarpi pollicis.

1207. It extends the last phalanx of the thumb upon the first, and, in other respects, acts as the preceding muscle.

OF THE EXTENSOR PROPRIUS INDICIS, OR INDICATOR.

1208. Similar in form to the extensor secundi internodii pollicis, this muscle arises, by short aponeuroses, from the posterior surface of the ulna, and from the interosseous ligament, a little beneath it, and to the outer side. From thence it descends outwards, increasing a little in size at first, and then diminishing. A tendon contained in its substance, becomes separated towards the posterior annular ligament of the wrist, unites with those of the extensor communis digitorum, by means of a membraniform cellular tissue (1186), passes into the same groove with it, is embraced by the same synovial membrane, and, on arriving at the back of the hand, is situated to the outside of that which the extensor communis sends to the fore-finger. It is confounded with it behind the articulation of the second metacarpal bone, with the first phalanx of the fore-finger, to terminate in the manner indicated, (1186.)

1209. Its *posterior surface* is covered by the extensor carpi ulnaris, extensor proprius minimi digiti, and extensor communis digitorum. The *anterior* lies on the ulna, the interosseous ligament, the extensor secundi internodii pollicis, the inferior extremity of the radius, and the back of the hand. Its *upper extremity* is confounded with that of the extensor secundi internodii pollicis.

1210. It extends the three phalanges of the fore-finger, and, in other respects, has the same uses as the other extensors.

5. *Radial Region.*

OF THE SUPINATOR LONGUS.

1211. This muscle, which is elongated, fusiform, flattened from before backwards in its upper fourth, and transversely in the rest of its extent, arises, by very short tendinous fibres, and over an extent of about two inches, from the outer edge of the humerus, between the brachialis internus and triceps extensor. An aponeurosis placed between it and the latter muscles, also furnishes it with some fibres. From thence it descends vertically, at first increases a little in thickness, then becomes considerably thinner, and terminates by a flat tendon, which, at first lying upon its anterior surface, becomes free about the middle of the fore-arm. This tendon, which is thin and rather broad above, becomes thicker and narrower as it descends, runs along the outer edge of the radius, and is inserted near the base of the styloid process of that bone, sending off a fibrous elongation, which lines the groove in which the extensor ossis metacarpi, and extensor primi internodii pollicis glide (1199.)

1212. The *anterior side* of this muscle is covered by the skin, and by the aponeurosis of the form-arm. The *posterior* covers the supinator brevis, extensor carpi radialis longior, pronator longus, flexor carpi radialis, flexor sublimis digitorum, flexor longus pollicis, and the radial artery and nerve. The *inner side* is applied upon the brachialis internus, and the radial nerve.

1213. When the palm of the hand is directed backwards, this muscle turns it forwards. It also assists in bending the fore-arm upon the arm, or the latter upon the former.

OF THE SUPINATOR BREVIS.

1214. This muscle is broad, thin, and triangular. It embraces the head of the radius. It arises from the outer condyle by a broad and thick tendon, firmly united to the common tendon, of which we have spoken (1186), from the external lateral ligament of the elbow joint, from the annular ligament of the radius, and by pretty distinct aponeurotic fibres, from a longitudinal ridge which is observed upon the posterior surface of the ulna. Its commencing tendon expands over the outer surface of the fleshy fibres, which are shorter and nearly vertical before, longer and more oblique the more posterior they are, and are all twisted round the radius, to the fore, outer, and back part of which they are attached by very distinct aponeuroses, deeply concealed in their substance.

1215. Its *outer surface*, which is convex, is covered anteriorly by the pronator longus and supinator longus muscles, and by the radial nerve and vessels; in the middle, by the radial extensors; posteriorly, by the extensor muscles of the fingers, extensor proprius minimi digiti, extensor carpi ulnaris and anconeus. Its *inner surface* is applied upon the outer part of the elbow joint, and of the upper articulation of the radius and ulna, upon the ulna, the interosseous ligament, and the radius. Its *posterior edge* covers the upper part of the extensor ossis metacarpi, and extensor secundi internodii pollicis. The *anterior* is notched above for the passage of the tendon of the biceps flexor, and is covered below by the pronator teres. These two edges unite, forming an acute angle, which is attached to the outer side of the radius, above the insertion of the latter muscle.

1216. The supinator brevis turns the radius upon its axis from before outwards, and brings the hand into supination.

OF THE EXTENSOR CARPI RADIALIS LONGIOR, OR RADIALIS EXTERNUS LONGIOR.

1217. Nearly of the same form as the supinator longus, beside which it is situated, this muscle arises beneath it, from the outer edge of the humerus, and from the aponeurosis which separates it from the triceps brachialis. It also receives some fibres from the upper part of the outer condyle. It forms a bundle at first flat, then larger and rounded, which descends vertically outwards of the fore-arm, and about a third down the radius terminates in a tendon at first thin and broad, then narrower and thicker, which at its lower part turns backwards, glides beneath the extensor ossis metarcarpi, and extensor primi internodii pollicis, and covers the tendon of the radialis externus brevior, with which it is connected by cellular tissue. Both tendons enter a particular groove which is formed behind the lower extremity of the radius, and where they are fixed by the posterior annular ligament of the carpus. A synovial membrane, tolerably supplied with moisture, lines the groove, is reflected over them, and descends nearly to their insertion. On emerging from this groove the two tendons separate. That of the radialis externus longior passes over the articulation of the carpus, and is inserted at the upper and outer part of the upper extremity of the second metacarpal bone.

1218. The *anterior surface* of this muscle, which is inclined outwards, is covered by the aponeurosis of the fore-arm, the supinator longus, extensor ossis metacarpi, and extensor primi internodii pollicis. The *posterior* covers the elbow joint, and the supinator brevis and radialis externus brevior muscles. At its upper part it is firmly united to the latter.

1219. It extends the hand upon the fore-arm, and the latter upon the hand.

OF THE EXTENSOR CARPI RADIALIS BREVIOR, OR RADIALIS EXTERNUS BREVIOR.

1220. This muscle is precisely similar to the preceding, behind which it is placed. It arises from the outer condyle by means of the common tendon (1186), which sends an aponeurotic prolongation over its inner surface, and of an aponeurotic partition lying between it and the extensor communis digitorum. It descends in the same direction as the radialis externus longior, degenerates into a tendon of the same length and form, which passes into the same groove (1217), and which is attached to the posterior and outer part of the upper extremity of the third metacarpal bone.

1221. Its *outer surface* is covered above by the radialis externus longior and supinator longus, below by the extensor ossis metacarpi, and extensor primi internodii pollicis muscles, the tendon of the extensor secundi internodii pollicis, and the skin. The *inner surface* covers the supinator brevis and pronator longus muscles, the radius, and the articulations of the wrist. Its *posterior edge* is intimately connected above with the extensor communis digitorum.

1222. Its uses are the same as those of the radialis externus longior.

D. MUSCLES OF THE HAND.

1. *External Palmar Region.*

OF THE ABDUCTOR POLLICIS.*

1223. Short, triangular, flat, broader above than below, this muscle arises externally and by very short aponeurotic fibres from the anterior surface of the os scaphoides; internally, from the upper, anterior, and external part of the anterior annular ligament of the wrist, and sometimes from a prolongation of the tendon of the extensor ossis metacarpi pollicis (1199.) From thence, it descends a little obliquely outwards. Its fibres converge toward each other, and terminate by a short and flat tendon, concealed at first in their substance, afterwards receiving a portion of the flexor brevis pollicis, and going to be inserted at the outer edge of the upper extremity of the first phalanx of the thumb, over the back of which it transmits some aponeurotic fibres to the tendon of the extensor secundi internodii pollicis.

1224. Its *anterior surface* is covered by a portion of the palmar aponeurosis and by the skin. The *posterior* covers the opponens and flexor brevis pollicis.

1225. It carries the thumb and the first metacarpal bone outwards and forwards.

OF THE OPPONENS POLLICIS.

1226. This muscle is also triangular, but thicker than the preceding, under which it is situated. It arises internally from the fore part of the anterior annular ligament of the wrist, by very long aponeurotic fibres; externally, from the outer edge of the groove which the trapezium presents for the tendon of the flexor carpi radialis; and posteriorly, from an aponeurotic septum interposed between it and the flexor brevis pollicis. Arising from these different places, the fleshy fibres, which are so much the longer and more oblique the lower they are, proceed downwards and outwards, and terminate by short aponeuroses all along the outer edge of the first metacarpal bone, and sometimes partially on the tendon of the extensor ossis metacarpi pollicis.

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* Soemmering divides it into two distinct muscles, which he designates by the names of *Abductores breves pollicis manus, interior et exterior.*

1227. Its *anterior surface* is covered by the preceding muscle and by the skin. The *posterior* is applied upon the anterior annular ligament of the wrist, the articulation of the trapezium with the first metacarpal bone (696), part of the anterior surface of the latter bone, and the flexor brevis pollicis muscle.

1228. It impresses upon the first metacarpal bone a rotatory motion which opposes the thumb to the other fingers.

OF THE FLEXOR BREVIS POLLICIS MANUS.

1229. Placed within and beneath the two preceding muscles, short, of a rather irregular form, and bifurcated at its two extremities, this muscle has two separate origins. It arises anteriorly and externally, from the fore and under part of the anterior annular ligament of the carpus, from the trapezium, and from an aponeurotic septum interposed between it and the opponens pollicis. Its other origin, which is posterior, is from the lower part of the os magnum, from the upper extremity of the third metacarpal bone, and from the ligaments by which they are united. The two portions of the muscle descend outwards, separated at first from each other, but soon united behind the tendon of the flexor longus pollicis, to which they afford a kind of longitudinal channel (1182.) Arrived at the lower extremity of the first metacarpal bone, they separate anew; the outer is confounded with the tendon of the abductor pollicis (1223), and is attached to the fore part of the upper extremity of the first phalanx of the thumb, and to the outer sesamoid bone of its articulation; the inner is united to the summit of the adductor pollicis, and in like manner goes to be attached to the phalanx and to the inner sesamoid bone. These two insertions take place each by a pretty strong tendon.

1230. The *anterior surface* of the flexor brevis pollicis is covered, at the middle, by the tendon of the flexor longus pollicis; internally, by those of the flexor profundus and by the first two lumbricales; externally, by an aponeurosis, by the skin, and by the abductor brevis pollicis. The *posterior surface* corresponds to the first metacarpal bone, to the first two dorsal and to the first palmar interossei, as well as to the tendon of the flexor carpi radialis. Its *outer edge* is often confounded with the opponens pollicis, and the *inner* with the adductor.

1231. It bends the first phalanx of the thumb upon the first metacarpal bone, and the latter upon the trapezium.

OF THE ADDUCTOR POLLICIS MANUS.

1232 This muscle, which is broad, thin, and triangular, is still more deeply seated than the flexor brevis. It arises from the three inferior fourths of the anterior surface of the third metacarpal bone, between two of the interosseous muscles, by short aponeuroses, to which succeed the fleshy fibres, which descend outwards converging, and terminate in a tendon united to that of the preceding muscle, and attached, along with it, to the inner and upper part of the first phalanx of the thumb. It often sends a fibrous prolongation to the tendon of the extensor secundi internodii pollicis.

1233. Its *anterior surface* is covered by the tendons of the flexor profundus, by the first two lumbricales, and by the skin. The *posterior* corresponds to the first three interossei, and also to the skin.

1234. This muscle carries the thumb inwards, and brings it near the other fingers.

2. *Internal Palmar Region.*

OF THE PALMARIS BREVIS.

1235. This name is given to four or five small bundles of muscular fibres which do not exist in all subjects, and which are met with immediately under the skin, at the inner and upper part of the palm of the hand. They are surrounded and separated by fat, have a transverse direction, and are parallel to each other. They arise from the anterior annular ligament of the wrist, and from the inner edge of the palmar aponeurosis, and terminate in the chorion of the skin. They correspond to the skin *anteriorly*, and to the abductor and flexor muscles of the little finger, and the ulnar artery and nerve, *posteriorly*. They vary much in their form, and their use is to increase the concavity of the palm by puckering the skin of the region which they occupy and pushing it forwards.

OF THE ABDUCTOR MINIMI DIGITI.

1236. This is a long flat muscle, broader at its middle part than at the extremities. It arises from the anterior and inferior parts of the os pisiforme, by aponeurotic fibres, which are continuous with the tendons of the flexor carpi ulnaris. From thence it descends vertically along the inner edge of the fifth metacarpal bone, and is attached to the inner side of the upper extremity of the first phalanx of the little finger, by a tendon of variable length, which is united to that of the flexor brevis of the same finger, and which sends some fibres to join the inner edge of the tendon of its extensors.

1237. Its *anterior surface* is covered by the palmaris brevis, by a very thin aponeurosis, and by the integuments. The *posterior* covers the opponens minimi digiti.

1238. It carries the little finger inwards and forwards, and separates it from the other fingers.

OF THE FLEXOR PROPRIUS MINIMI DIGITI.

1239. This muscle does not occur in all subjects, and when it does exist, it varies much in size, as well as in form. It is in general very thin, and very narrow. It arises, by aponeuroses, from the anterior annular ligament of the wrist, and the anterior edge of the process of the os unciforme, whence it descends a little outwards, becoming narrower, to be united to the outer part of the tendon of the preceding muscle, and to terminate along with it. Its connections are absolutely the same.

It bends the first phalanx of the little finger, and draws forwards the fifth matacarpal bone.

OF THE ADDUCTOR OSSIS METACARPI MINIMI DIGITI, OR OPPONENS MINIMI DIGITI.

1240. It has nearly the same form and disposition as the opponens pollicis (1226), but its size is less. Having the same origins as the preceding muscle, its fleshy fibres, which are so much the longer and more oblique the lower they are, descend inwards, and terminates along the inner edge of the fifth metacarpal bone, by very distinct aponeurotic fibres. Its *anterior surface* corresponds to the abductor and flexor brevis of the little finger, and to an aponeurotic expansion, sent off by the tendon of the extensor carpi ulnaris (1193). The *posterior surface* is applied upon the last interosseus muscle, the fifth metacarpal bone, and the tendon of the flexor sublimis, which goes to the little finger.

It carries the fifth metacarpal bone forwards and outwards, and thus augments the cavity of the hand.

3. *Middle Palmar Region.*

OF THE LUMBRICALES.*

1241. The *Lumbricales* are four small, slender, elongated, fusiform fleshy bundles, folded upon themselves, situated in the palm of the hand, and distinguished into first, second, third, and fourth, according to their relative position, counting from without inwards, and diminishing in size in the same order. They arise towards the upper part of the hand, the first from the fore and outer part of the tendon of the flexor profundus, which goes to the fore-finger; the three following from the separation of the other tendons of the same muscle, so as to be attached to two of them at once. From thence they descend, following different directions; the middle two vertically, the outer outwards, and the inner inwards; and when they have arrived at the outer side of the articulation of the metacarpal bones, with the first phalanges of the fingers, they become very thin, and terminate by flattened tendons, which proceed behind the first phalanx, becoming broader, are confounded with the tendons of the corresponding interossei, and go, along with them, to be lost in the outer edge of the tendons of the extensor digitorum communis. These tendons vary much in their dispositions. They frequently divide into two, and one of their branches is attached to the phalanx.

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* *Lumbricus*, an earth-worm.

1242. Their *anterior surface* is covered by the tendons of the flexor digitorum profundus, by the palmar aponeurosis, and by the collateral vessels and nerves of the fingers. The posterior surface lies upon the interossei, the inferior transverse metacarpal ligament, and the phalanges.

1243. They bend the fingers upon the metacarpus, carry them a little outwards, and fix the tendons of the extensor communis digitorum.

OF THE INTEROSSEI.

1244. These muscles are seven in number, two for each of the middle fingers, and one for the little finger. Four are situated on the back of the hand, and only three in the palm. According to their uses, they are designated by the names of abductors and adductors.

1245. *Interossei indicis.* Its *abductor* is the largest of the interossei. It is of a triangular form, thin, and flat, and arises along the outer edge of the second metacarpal bone, and from the upper half only of the inner edge of the first, as well as from the ligaments which connect these bones with the trapezium. Between these two origins, there exists, superiorly, an interval through which the radial artery passes. The two fasciculi which arise from them unite afterwards into a single one, which terminates in a tendon, partly attached to the outside of the upper extremity of the first phalanx, partly to the extensor tendon of the index. Its *posterior surface* is covered by the skin; the *anterior* by the first lumbricalis, the flexor brevis and abductor pollicis, and by the skin. It draws the fore-finger outwards, and the first metacarpal bone inwards.

The *adductor* of the fore-finger is situated in the palm of the hand. Thin and prismatic, it arises from the two upper thirds of the inner side of the second metacarpal bone, and from the ligaments by which that bone is connected with the trapezoides. It is terminated by a tendon, appearing sooner internally than externally, which is inserted in the same manner as the preceding, but on the fore-side of the first phalanx of the index. Its *anterior surface* is covered by the flexor brevis and adductor pollicis. The inner corresponds to the next muscle. It carries the fore-finger inwards.

1246. *Interossei digiti medii.* The *abductor*, which is situated at the back of the hand, is larger than the preceding, and has the form of a triangular prism. It arises from the whole inner side of the second metacarpal bone, behind the origins of the adductor indicis, from which it is only separated by a very thin cellular line, and from the whole outer side of the third bone of the same region, as well as from the ligaments which connect these bones with each other and with the neighbouring bones. Its *upper extremity* is perforated for the passage of an artery. The *lower* is terminated by a tendon, which, like the preceding, is attached to the outer side of the first phalanx of the middle finger, and of its extensor tendon. Its *posterior surface*, which is very broad, is covered by the skin and by the tendons of the extensor muscles of the fore-finger, as well as by an aponeurosis which passes from the second metacarpal bone to the third. The *anterior surface* is very narrow, and concealed under the flexor brevis and adductor pollicis.

It carries the middle finger outwards.

The *adductor* of the middle finger is also situated at the back of the hand, and has the same form as the adductor. It arises from the inner side of the third metacarpal bone, and from the posterior part of the outer side of the fourth, as well as from the ligament by which they are connected. At its upper part it is bifurcated for the passage of an artery. Below, it terminates, like the others, in a tendon which is attached to the inner side of the upper extremity of the first phalanx, and of the extensor tendon of the middle finger. Its *posterior surface* is covered by the skin and the tendons of the common extensor of the fingers. It carries the middle finger inwards.

1247. *Interossei Digiti Annularis.* The *abductor*, which is placed in the palm of the hand, and is also thick and prismatic, arises from the two anterior thirds of the outer surface of the fourth metacarpal bone and from the ligaments by which they are connected with the neighbouring bones. Its inferior tendon is attached to the outer side of the first phalanx and of the exterior tendon of the ring finger. Its *anterior surface* is covered by the lumbricales and by the tendons of the flexor profundus.

It carries the ring-finger outwards.

The *adductor*, which is triangular and prismatic, and situated on the back of the hand, arises from the whole inner side of the fourth metacarpal bone, and from the posterior part of the outer edge of the fifth, as well as from the ligaments by which they are connected. Its *upper extremity* is traversed by an artery; the *lower* terminates in a tendon which is attached to the inner side of the ring-finger. Its *posterior surface* is covered by an aponeurosis which goes from the fourth to the fifth metacarpal bone, by the extensor tendons of the little finger, and by the skin; the *anterior* is concealed above, beneath the interosseous muscle of the little finger, and appears below between it and the preceding muscle.

It carries the ring-finger inwards.

1248. *Interosseus Digiti Minimi.* It is an *abductor*, of the same form as the others, and is inserted into the two anterior thirds of the outer surface of the fifth metacarpal bone, and into the ligaments by which it is connected with the os unciforme. Its tendon is attached to the outside of the upper extremity of the first phalanx and of the exterior tendon of the little finger. Its *anterior surface* is covered by the opponens minimi digiti; the outer corresponds to the preceding muscle.

It carries the little finger outwards.

1249. From their connections with the tendons of the extensors of the fingers, the interossei and lumbricales may contribute to extend the fingers.

OF THE ENVELOPING APONEUROSIS OF THE UPPER EXTREMITY.

1250. A fibrous sheath, varying in strength and closeness in the different parts of its extent, surrounds all the muscles of the upper extremity from the shoulder to the hand. The place where it originates cannot be precisely determined. It is evidently confounded with the cellular tissue in the arm-pit, before and behind which it proceeds as far as the tendons of the pectoralis major (840) and latissimus dorsi (884). The deltoid muscle does not appear to be covered by it: it seems only to be detached from its humeral tendon; but beyond that muscle it is continuous with an aponeurosis which ascends to the spine of the scapula, covering the infra-spinatus. From these different points of origin, to the elbow joint, this sheath bears the name of *brachial aponeurosis.* It descends along the arm, which it closely envelopes, is separated from its muscles by nerves, vessels, and much cellular tissue, adheres nevertheless to the different fibrous laminæ which separate the brachialis internus from those which surround it, sends off near the elbow some prolongations into the subcutaneous cellular tissue, is inserted by two bundles into the external and internal condyles, and is continued before and behind over the fore-arm. It is very delicate, transparent, and is cellular in several places. It also however presents oblique, longitudinal, and transverse fibres, which cross each other in various directions. Of all the aponeuroses of the limbs, it is the least capable of resistance. Its *outer surface* is covered by the skin, by cellular tissue, and by the superficial veins, nerves, and lymphatics of the arm. It appears to form very thin sheaths for these different organs. Its *inner surface* is applied upon all the muscles of the arm, and upon the bundle of vessels and nerves which descends along its inner and fore part.

1251. From the elbow to the hand, the fibrous sheath of which we are speaking is called the *Anti-brachial Aponeurosis*, or *Aponeurosis of the Fore-arm.* It is evidently continuous with the preceding portion, and receives moreover anteriorly a lamina detached from the tendon of the biceps (1147), laterally bundles of fibres arising from the outer and inner condyles, and posteriorly a prolongation of the tendon of the triceps (1154). Between the inner condyle and olecranon, it sends off a transverse bridle which binds the two attachments of the flexor carpi ulnaris, and under which passes the ulnar nerve, which even receives a sort of sheath from it. The portion of it which covers the anconeus is very thick and does not adhere. The sheath descends along the fore-arm, and arriving at the wrist, is continued into the two annular ligaments, and is traversed by the tendons of the flexor carpi ulnaris and palmaris longus. It is also separated externally from the skin by nerves and by venous and lymphatic vessels. It sends between them, and especially above, bundles of fibres which pass into the skin, forming areolæ and arches in which the branches of the superficial venous and nervous plexus of the fore-arm are obliged to pass. It covers all the superficial muscles of the fore-arm, to which it adheres above by the different fibrous partitions which we have already pointed out between the pronator teres and flexor carpi radialis, the flexor digitorum sublimis and palmaris longus, the palmaris longus and flexor carpi ulnaris, the extensor digitorum communis and extensor minimi digiti, the extensor minimi digiti and radialis longior, the radialis longior and extensor carpi ulnaris, the latter muscle and anconeus. It is free below and externally. On the inner side it is inserted into the whole inner edge of the ulna. It is denser and stronger than the brachial aponeurosis; but its fibres are much more distinct at the fore and outer part than internally or behind. These fibres have no constant direction, but cross each other in all directions, and leave between them small quadrilateral openings which are traversed by blood vessels.

1252. Before the bend of the elbow, and the prolongation of the biceps muscle, there is observed a plane of very superficial fibres, which descend inwards, and are effaced about the upper fourth of the fore-arm, to become transverse. This plane divides into two laminæ, one of which passes between the biceps and brachialis internus, while the other forms a sheath around the median nerve and vein.

OF THE ANNULAR LIGAMENTS OF THE WRIST.

1253. *Anterior Annular Ligament.* This is a strong and broad fibrous bridle, of a quadrilateral form, broader transversely than from above downwards, extended at the fore part of the carpus, and converting into a canal the groove which that part presents. It is attached externally to the fore part of the trapezius and scaphoides, and furnishes insertions to the abductor, opponens, and flexor brevis of the thumb. Internally, it is attached to the pisiform bone, the process of the os unciforme, and a ligament which descends from the one to the other (692). It affords some points of origin to the opponens minimi digiti, and receives a prolongation of the tendon of the flexor carpi ulnaris. Its *upper edge* is continuous with the aponeurosis of the fore-arm ; the *lower* is confounded with the palmar aponeurosis. Its anterior surface is covered by the tendon of the palmaris longus, which is intimately united to it by the cutaneous palmar muscle, the skin, and the ulnar nerve and vessels. The *posterior surface* contributes to the formation of a canal, in which pass the tendons of the two common flexors and the median nerve. It also covers the flexor carpi radialis and flexor longus pollicis. The fibres of this tendinous band are very numerous, transverse, and very close upon each other.

1254. *Posterior Annular Ligament.* This is placed behind the wrist-joint, where it is extended transversely over the fibrous sheaths of the extensor ossis metacarpi and extensor primi internodii pollicis, the radial extensors, extensor secundi internodii pollicis, extensor communis digitorum, extensor proprius indicis, extensor minimi digiti, and extensor carpi ulnaris. It belongs much more than the preceding to the aponeurosis of the fore-arm, and must not be confounded with these sheaths, which it only serves to cover. Its fibres are transverse, parallel, and very white. They are traversed by blood-vessels. They are attached on the one hand to the outer and lower part of the radius, and terminate on the other, at the lower part of the ulna, and at the internal region of the os pisiforme.

This ligament is much weaker than the anterior.

OF THE PALMAR APONEUROSIS.

1255. This aponeurosis, which is extremely dense and strong, covers the fore-part of the hand. It is of a triangular form, broader above than below. It seems to arise above from the expansion of the tendon of the palmaris longus, but it also receives fibres from the anterior annular ligament of the wrist, (1253,) and four or five oblique bundles detached from the lower part of the aponeurosis of the fore-arm. The fibres of which it is composed descend, becoming smaller and diverging, to the lower part of the metacarpus. There they separate, and form four isolated slips, connected by new transverse and bifurcated fibres, towards the articulations of the metacarpal bones and phalanges, for the passage of the flexor tendons. Each of the branches of their bifurcation twists backwards, and loses itself in the transverse and inferior metacarpal ligament, forming with it and the connecting transverse fibres, holes which are traversed by the lumbricales. The *two lateral edges* of this aponeurosis give attachment to two very thin and transparent prolongations which cover externally and internally the muscles of the thumb and those of the little finger. Its *anterior surface* is connected with the dermis by numerous fibres, and adheres to an adipose tissue disposed in small rounded masses. The *posterior surface* lies over the flexor tendons, the lumbricales, and the vessels and nerves of the palm of the hand.

II. MUSCLES OF THE INFERIOR EXTREMITIES.

A. MUSCLES OF THE HAUNCH AND THIGH.

1. *Region of the Hips.*

OF THE GLUTÆUS MAXIMUS.

1256. This muscle which is broad, very thick and quadrilateral, is what especially forms the hip. It is attached above by short aponeurotic fibres, to the upper part of the crest of the iliac bone, to an uneven, convex, and narrow portion of the outer surface of the same bone, (389,) to the posterior sacro-iliac ligament, over which it is continued into the aponeurosis of the sacro-spinalis and latissimus dorsi, (823, 884;) in the middle, to the inequalities of the posterior surface of the sacrum, to the circumference of the notch which terminates the sacral canal, and to the lateral parts of the coccyx, as far as the summit of that bone; externally and inferiorly, to the posterior sacro-sciatic ligament. The fleshy fibres arising from these different places, collect into very distinct fasciculi, separated from one another by lines filled with cellular tissue. All these fasciculi, which are parallel to each other, and longer the nearer they are to the lower part of the muscle, descend obliquely outwards and forwards, towards the great trochanter. The upper fasciculi terminate at the upper part of a tendon, very thick and narrow below, broad and thin above, and so confounded externally with the fascia lata, as to be inseparable from it. This tendon, as it descends, receives the other fleshy fibres in succession along its posterior edge, from the level of the great trochanter, and is afterwards inserted, in an extent of about three inches, into a rough impression, which proceeds from the base of the great trochanter to the linea aspera of the femur, and into the upper part of that line, between the third adductor and the triceps.

1257. The *posterior surface* of the glutæus maximus is immediately covered by a very thin lamina of the fascia lata, and connected with the skin by a layer of extremely thick adipose tissue. The *anterior surface* is applied upon the iliac bone, the sacrum, the coccyx, the origin of the sacro-spinalis, the glutæus medius, pyramidalis, gemelli, obturator internus, and quadratus femoris muscles, the sciatic nerve, the tuber ischii, the posterior sacro-sciatic ligament, the upper extremity of the biceps and semitendinosus, the great trochanter, and the adductor magnus and triceps extensor muscles.

Its *upper edge*, which is very thin, is connected with the glutæus medius by a prolongation of the fascia lata. The *lower edge* is the longest of all, and is free of adhesions. The *outer* is united in its whole extent to the fascia lata.

1258. *Synovial Bursa.* It is very thin, oval, always well supplied with synovia, and very frequently furnished with replications in its interior. It is expanded upon the outer surface of the trochanter, the neighbouring portion of the triceps, and the inner surface of the tendon of the glutæus maximus, the motion of which it facilitates.

1259. The glutæus maximus extends the thigh upon the pelvis, and the pelvis upon the thigh. It turns the thigh outwards by rotation, and acts very powerfully in standing and progression.

OF THE GLUTÆUS MEDIUS.

1260. The *Glutæus medius* is a broad, strong, radiated, triangular muscle, with continuous fleshy bundles, much thinner than the preceding muscle, under which it is partly situated. It arises by short aponeurotic fibres from the outer surface of the iliac bone, between the two curved lines, from a kind of aponeurotic arch which prevails along the inferior curved line, from the three anterior fourths of the iliac crest, and from the inner surface of the portion of the fascia lata which descends from the superior and anterior iliac spine. Proceeding from these different points, the fleshy fibres descend converging, and following different directions, the anterior, which are short, obliquely backwards, the middle, which are longer, vertically, and the posterior, which are still longer, obliquely forwards. They terminate upon the two surfaces of a broad aponeurosis, which they conceal for some time in their substance, and which is longer posteriorly than anteriorly. This aponeurosis contracts and becomes thicker as it descends. It is left by the fleshy fibres towards the great trochanter, where it is converted into a tendon thinner before than behind, which is inserted into the whole upper edge of that eminence, prolonging itself a little upon its fore and outer part, and uniting with the glutæus minimus.

1261. Its *outer surface*, which inclines a little backwards, is covered in its posterior half by the glutæus maximus, and in its anterior by the fascia lata. The *inner* surface is applied upon the iliac bone, the glutæus minimus, pyramidalis and triceps extensor muscles, and the gluteal artery. Its *anterior edge* is connected above with the tensor vaginæ femoris, from which it is separated below by an interval in which there occur a great quantity of cellular tissue and branches of the external circumflex artery. The *posterior edge* is at its upper part parallel to the pyramidalis muscle, whose direction it crosses below. The two tendons are here separated by a synovial bursa.

1262. This muscle draws the thigh inwards. By its anterior part, it turns the femur in rotation inwards, and in the contrary direction by the posterior part. It also acts in standing and in progression.

OF THE GLUTÆUS MINIMUS.

1263. The *Glutæus minimus* is smaller than the medius, and is situated under it. It is a flat muscle, of a triangular form, with radiating fibres. It arises, by short aponeuroses, from the inferior curved line of the iliac bone, and from the anterior region of its crest, beneath the glutæus medius, as well as from the whole space comprised between these parts and the edge of the cotyloid cavity. Proceeding from thence, the fleshy fibres converge, and descend, the middle ones vertically, the anterior and posterior obliquely. The middle and posterior go to the inner surface of a broad aponeurosis, of which the outer part receives some bundles from the glutæus medius, and which is accompanied by the anterior fibres of the glutæus minimus as far as the trochanter, where it is converted into a strong and thick tendon, which embraces the anterior region of that eminence. A small synovial capsule, in most cases, favours its motions.

1264. The *outer surface* of this muscle, which is inclined backwards, is covered by the preceding in the greater part of its extent, and a little, posteriorly, by the pyramidalis. The *inner surface* covers the iliac bones, the fibrous capsule of the thigh joint, the curved tendon of the rectus femoris, and the triceps extensor in a small part. Its *upper edge* is convex; the *anterior* is a little connected below with the glutæus medius; the *posterior* is covered above by the pyramidalis, to which it is parallel below.

1265. Its uses are the same as those of the preceding muscle.

2. *Iliac Region.*

OF THE ILIACUS INTERNUS.

1266. This muscle lies in the iliac fossa, from which it borrows its name. It is broad and thin above, thick and narrow below, triangular, radiated, and flabelliform. It arises, by very small aponeuroses, from about the upper three-fourths of the iliac fossa, the inner lip of the two anterior iliac spines, the ilio-lumbar ligament, and the two anterior thirds of the inner lip of the iliac crest. From these points its fibres converge and descend, the inner, which are very short, vertically, the outer more and more obliquely. The latter are the longest. They are all successively inserted into the outer edge of the tendon of the psoas magnus, which they accompany to the small trochanter (809,) passing with it under the crural arch.

1267. Its *anterior surface*, which is concave above, and convex below, is covered, above the crural arch, by the peritoneum, and by the cœcum to the right, and the sigmoid curve of the colon to the left. The portion of this surface which is below the arch, corresponds externally to the sartorius; internally, to the pectineus and the crural vessels and nerves; anteriorly, to the cellular tissue of the fold of the groin, which separates it from the crural aponeurosis. Its *posterior surface* covers the iliac fossa, the upper extremity of the rectus muscle, and the articulation of the thigh.

1268. It bends the thigh upon the pelvis, and the latter upon the thigh, and acts powerfully in maintaining the body in the erect posture.*

3. *Pelvi-trochanteric Region.*

OF THE PYRIFORMIS.

1269. This muscle is of an elongated conical form, flattened from before backwards. It is situated in the pelvis and at the upper and back part of the thigh, and arises by a kind of digitations from the anterior surface of the sacrum, to the outside of the anterior sacral holes, and in the spaces by which they are separated from each other. It is also attached to the lower part of the posterior sacro-sciatic ligament (627,) and to the upper and back part of the ossa ilii. From thence it proceeds outwards and a little downwards, contracts, issues from the pelvis by the sciatic notch (406,) runs along the glutæus medius and glutæus minimus, and terminates by a tendon. The latter, which is at first broad and concealed by the fleshy fibres, appears sooner before than behind, is separated from the tendon of the glutæus medius by a synovial bursa (1261,) is confounded by its upper edge with the tendon of the gemellus superior, and is inserted, above the latter muscle, in the digital cavity of the great trochanter (496.) Sometimes the pyramidalis is longitudinally split, in which case a branch of the sciatic nerve passes between its two portions.

1270. In the pelvis, its *anterior surface* is covered by the rectum, the sciatic plexus, and the hypo-gastric vessels. After emerging from that cavity, it is applied upon the iliac bone, the capsule of the hip-joint, and the glutæus minimus. Its *posterior surface* is covered by the sacrum and the glutæus maximus. Its *upper edge* corresponds internally to the glutæal artery, and externally to the glutæus medius and glutæus minimus. The *lower edge* corresponds, internally, to the anterior sacro-sciatic ligament, and externally, to the gemellus superior, from which it is at first separated by the sciatic nerve.

1271. This muscle rotates the thigh outwards. It may also make the pelvis turn upon the thigh.

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* This muscle should not be considered separately from the psoas magnus.

OF THE OBTURATOR INTERNUS.

1272. This muscle is almost entirely situated within the pelvis. It is flat and triangular, forms an angle, and is reflected upon itself as it emerges from the pelvis, to proceed to the upper and posterior part of the thigh. It arises, by rather indistinct aponeurotic fibres, from the posterior surface of the pubes, within and above the obturator hole, from the obturator ligament (637,) excepting towards the aperture through which the obturator vessels and nerve pass, where it is connected with a small fibrous arch, and from the bony surface which separates the obturator hole from the sciatic notch, immediately beneath the upper strait of the pelvis. Arising from all these points, the fleshy fibres converge, and descend under the sciatic spine. But before they reach that point, they meet with four or five distinct, isolated, tendinous slips, occupying at first the interior of the muscle, then appearing upon its outer surface, approaching each other, and at length turning outwards over the edge of the small sciatic notch, as over a pulley, where they are lodged each in a small groove incrusted with cartilage. On emerging from the pelvis, these slips unite into a single horizontal, thick and flat tendon, separated from the fleshy fibres, situated between the two gemelli, confounded with their tendons and inserted along with them, into the cavity of the trochanter, between the pyramidalis and obturator externus.

1273. The *outer surface* of this muscle is applied within the pelvis against the iliac bone and obturator ligament. Externally of that cavity, it is covered by the sciatic nerve and glutæus maximus. Its *inner surface* corresponds to an aponeurosis into which is inserted the levator ani (1078), and passes over the capsule of the ilio-femoral articulation.

1274. *Synovial Bursa.* At the place where the obturator muscle bends, there is observed a synovial capsule, plentifully moistened, lining the cartilaginous layer which incrusts the small sciatic notch, and reflected over the slips of the tendon, and a little over the outer surface of the muscle, especially at its outer part.

1275. It rotates the thigh outwards, and draws it in the same direction.

OF THE OBTURATOR EXTERNUS.

1276. Situated at the upper and inner part of the thigh, and of the form of a flattened conoid, this muscle arises from the lamina of the iliac bone which limits the obturator hole anteriorly, and from the inner part of the anterior surface of its ligament. From thence, it descends outwards, becoming narrower, then ascends behind the neck of the femur, where its fleshy fibres terminate upon a tendon which comes from several slips that had existed in the substance of the muscle, contracts, becomes thicker, and is inserted into the cavity of the trochanter beneath the inferior gemellus, after contracting strong adhesions with the ilio-femoral capsule.

1277. Its *anterior surface,* which is inclined downwards, is covered by the pectineus, the adductors, and quadratus. The *posterior* is applied upon the iliac bone, the obturator ligament, from which it is separated by cellular tissue externally, and upon the fibrous capsule of the hip-joint. Its *upper edge* corresponds internally to the obturator nerve and vessels. The *lower edge* is placed, also internally, above the attachment of the adductor magnus.

1278. This muscle rotates the thigh inwards, and draws it towards the other.

OF THE GEMELLUS SUPERIOR,*

1279. Elongated, flattened, broader and thicker at its middle part than at its extremities, it arises from the outer lip of the sciatic spine, then proceeds transversely outwards, is confounded with the tendon of the obturator internus, and is inserted at the upper part of the inner surface of the great trochanter. Its *posterior surface* is covered by the sciatic nerve and glutæus maximus; the anterior covers the ossa ilii, and the capsule of the hip joint.

It rotates the thigh outwards, and draws it from the other.

OF THE GEMELLUS INFERIOR.

1280. It has the same form, connections, and uses as the preceding muscle; but it is attached on the one hand to the upper and back part of the tuber ischii, and, on the other, to the digital cavity of the great trochanter, above the obturator externus (1276.) The two tendons of the gemelli unite behind that of the obturator internus, so as to present a kind of groove.

OF THE QUADRATUS FEMORIS.

1281. This muscle is situated transversely at the posterior and upper part of the thigh. It is thin, flat, and quadrilateral, and arises, by pretty long aponeurotic fibres, from the outer side of the sciatic tuberosity before the semi-membranosus. It then proceeds horizontally, between the gemellus inferior and adductor magnus, to the lower part of the posterior edge of the great trochanter, where it is inserted by aponeuroses, which are also pretty long. Its *posterior surface* is covered by the sciatic nerve, and by the glutæus maximus, semi-membranosus, and adductor magnus muscles. The *anterior* covers the obturator externus, the extremity of the tendon of the psoas magnus, and the posterior part of the small trochanter, from which it is separated by a synovial bursa.

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* M. Chaussier confounds this muscle with the following under the general name of *ischio-trochanterien,* and Soemmering also designates them collectively under that of *musculi gemini.*

Its uses are the same as those of the gemelli.

4. *Anterior Crural Region.*

OF THE SARTORIUS.

1282. The *sartorius* is the longest muscle in the human body, and resembles a kind of ribbon, a little broader at its middle part than at the extremities, and lying obliquely along the inner part of the thigh. It arises, by a short tendon, equally expanded over its two surfaces, from the anterior and superior iliac spine, between the tensor vaginæ femoris and iliacus, and a little from the notch which separates the two anterior spines of the ileum. From thence it descends, becoming broader, and passing obliquely inwards and backwards, as far as the upper third of the thigh. It then proceeds vertically, preserving the same breadth to the distance of a third from the lower extremity of the bone; and lastly, opposite the knee, it contracts, and passes obliquely forwards and outwards, to the inner part of the upper extremity of the tibia, where it is inserted by a pretty long flat tendon, of which the anterior edge, arising very high upon the fleshy fibres, is confounded with the portion of the fascia lata which surrounds the knee, while the posterior contributes to form the aponeurosis of the leg. At its lower extremity, this tendon expands into a strong aponeurosis which passes over the tendons of the semi-tendinosus and gracilis, uniting with them, and terminates upon the tibia before them.

1283. Its *anterior surface* is covered by the fascia lata. The *posterior* is applied, from above downwards, upon the united psoas magnus and iliacus internus, the rectus femoris, triceps extensor cruris, adductor longus, adductor magnus and gracilis muscles, the crural artery about the middle of the thigh, and, at its lower part, the internal lateral ligament of the knee-joint. Its *inner edge* forms above with the adductor longus, a triangular space, in which is lodged the crural artery, with the vein and nerve of the same name.

1284. It bends the leg upon the thigh, and brings its inferior extremity toward that of the opposite side, so as to make them cross each other. By continuing to act, it bends the thigh upon the pelvis. If the leg cannot be bent, it draws the whole inferior extremity upon the pelvis, turning it outwards in rotation. It prevents the pelvis from falling backwards, or bends it upon the thigh.

OF THE RECTUS FEMORIS.

1285. The *Rectus Femoris*, is an elongated muscle, flattened at its extremities, slightly rounded and broader at the middle, and exactly fusiform. It lies vertically at the upper part of the thigh, and arises from the iliac bone by two tendons. One of them is narrow and embraces the anterior and inferior spine of that bone; the other, which is longer, broader, and curved, turns round the edge of the cotyloid cavity, to the upper part of which it is attached, sending some fibres into the capsule of the articulation. These two tendons, after a short passage, unite into a single tendon, which descends vertically, and almost immediately expands into an aponeurosis which occupies the fore part of the upper third of the muscle, and gives rise posteriorly to the fleshy fibres. These form a vertical and bulging bundle, and are inserted successively into the fore part of another aponeurosis which lies upon the posterior surface of the muscle, from the place where the other terminates. This aponeurosis, after becoming narrower and thicker, separates and forms a flat tendon, which is confounded with that of the triceps extensor, (1291.)

1286. The *anterior surface* is covered by the fascia lata, and by the iliacus and sartorius muscles; the *posterior* is applied upon the ilio-femoral articulation, the external circumflex vessels, and the triceps extensor.

1287. It extends the leg upon the thigh, or the thigh upon the leg. If the leg is extended, it bends the thigh upon the pelvis, or the pelvis upon the thigh. When one is standing, it fixes the pelvis, and prevents it from falling back.

OF THE TRICEPS EXTENSOR.

1288. This muscle is extremely large. It is divided into three bundles above, and is simple at its lower part. It embraces the femur on all sides, from the base of the trochanters to the patella, and from the inner edge of the linea aspera to its outer edge. Its *outer bundle*, (the *Vastus externus* of the older writers,) which is larger than the others, and thicker above than below, is attached to the base and fore part of the great trochanter, as well as to the outer lip of the linea aspera, and, together with the glutæus maximus, to the ridge by which it is connected with the great trochanter, by a broad aponeurosis, expanded over its outer surface to near the middle of the thigh, thick and dense at its upper part, thin and with separated fibres below. The fleshy fibres of the muscle arise from the inner surface of this aponeurosis and another aponeurotic lamina placed between it and the short portion of the biceps, and from the outer surface of the femur. They are directed obliquely downwards and forwards, and are longer above than below, where they become nearly transverse. The last fibres even take their origin from the two upper thirds of the line which descends to the outer condyle of the femur. They form together a mass broader and thicker at its middle part than at the extremities, which is at first separated from the middle bundle by a thin layer of cellular tissue, but which is presently so confounded with it as to be no longer separable.

1289. The *inner bundle*, (or *Vastus internus*,) is not always very distinct from the middle, and is much smaller than the outer. It appears more bulky below than above. It is attached to the anterior and inferior part of the base of the small trochanter, and to the inner lip of the linea aspera, by a less broad and less thick aponeurosis than that of the outer portion, and which also descends to the middle of the thigh. The fleshy fibres come from the inner surface and anterior edge of this aponeurosis as well as from the inner surface of the femur, and from the two upper thirds of the ridge which descends to the inner condyle. They are directed obliquely downwards, forwards, and outwards. The upper are longer than the lower; which latter are confounded along the linea aspera with the adductor muscles, and are united to them by an aponeurosis which is traversed by vessels.

1290. The *middle bundle* is the smallest. It arises from the fore part of the base of the neck of the femur, along the oblique ridge which proceeds from the great to the small trochanter, and from the three upper fourths of the anterior surface of the body of the femur. Its fleshy fibres form a mass which descends, increasing in size, and which, at first isolated, soon becomes confounded with the two preceding portions, but first with the inner.

1291. These three portions are thus united by very broad aponeuroses. One of these commences very high upon the inner surface of the first; the other rises about the same level upon the outer surface of the second; and the last appears toward the middle of the anterior surface of the third. They approach each other as they descend, become intimately united, and form a tendon, at first broad and thin, afterwards narrower and thicker, and at last confounded with that of the rectus femoris (1285), with which it is inserted into the whole upper part of the patella, sending off laterally two fibrous expansions which embrace that bone and are attached to the tuberosities of the tibia, along with portions of the fascia lata. The fleshy fibres accompany it internally to very near the patella.

1292. The *anterior surface* of the triceps cruralis is covered externally and above by the tendons of the glutæus minimus and glutæus maximus; farther down, by the fascia lata and its tensor muscle, and at its lowest part, by the short portion of the biceps. In the middle, it is in connection with the iliacus and rectus femoris, and with the external circumflex vessels. Internally, the fascia lata, the crural artery, and the sartorius muscle are applied upon it. Its *posterior surface* covers the whole surface of the body of the femur, from which it is separated below by a considerable quantity of adipose cellular tissue, and the articulation of the femur and tibia.*

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* A few detached muscular fibres, frequently found under the lower part of the middle portion, and attached to the *capsule* of the knee-joint, have been described by some authors as a separate muscle, under the name of *Subcruræus* or *Capsularis*. K.

1293. This muscle contributes powerfully to extend the leg upon the thigh, and the latter upon the former.

5. *Posterior Crural Region.*

OF THE SEMI-TENDINOSUS.

1294. This muscle is very long, slender, tendinous, and rounded below; thin, fleshy, flattened, and broader above. It is extended obliquely at the back part of the thigh, and arises behind the semi-membranosus, from the tuberosity of the ischium, by a membranous tendon, which is at first common to it, along an extent of about three inches, with the long portion of the biceps, and from the anterior surface of which the fleshy fibres arise. These descend in a converging manner, and a little obliquely inwards, the bundle which they form contracting and becoming thicker. When it has arrived at the middle part of the thigh, after being generally traversed by an aponeurotic intersection, it changes into a tendon, at first concealed among the fleshy fibres, then appearing at the inner side, and at length becoming free, slender, and round, which descends behind the inner side of the knee joint, between the internal head of the gastrocnemius and semi-membranosus, turns forward upon the tibia, becomes broader, and is united to the posterior edge of the tendon of the gracilis, as well as with the inner surface of that of the sartorius (1282) to terminate with them upon the tibia.

1295. Its *posterior surface* is immediately covered by the fascia lata, and a little at its upper part by the glutæus maximus. The *anterior* is applied upon the semi-membranosus and adductor magnus.

1296. A mucous bursa occurs between its upper part and the biceps and semi-membranosus, and another at its lower part between the internal ligament of the articulation and its tendon united with those of the sartorius and gracilis.

1297. It bends the leg and turns it inward by rotation. It also bends the thigh upon the leg. In standing it keeps the pelvis erect, and sometimes even contributes to draw it backwards.

OF THE SEMI-MEMBRANOSUS.

1298. Placed beneath the preceding muscle, flat, thin, narrow, and aponeurotic in its upper third, broader, thicker, quadrilateral, and fleshy in the rest of its extent, excepting at the very lowest part, where it is rounded, this muscle arises from the tuber ischii, behind the quadratus and before the semi-tendinosus and biceps, by a flat tendon, of which the outer edge is much thicker than the inner, and which descends very low upon the outer and back part of the fleshy body, to be afterwards concealed in its substance, the fleshy fibres are short and parallel, and are directed obliquely inwards. They form a pretty long bundle, thin at its extremities and thick in the middle, and terminate successively in a tendon which occupies their inner edge. This tendon, which is isolated behind the knee joint, thick and round, is contiguous anteriorly with that of the external head of the gastrocnemius, from which it is separated by a synovial capsule, and divides into three portions. The outer, which is thin and narrow, ascends obliquely backwards and outwards upon the synovial capsule of the knee-joint, which it contributes to strengthen, and is attached above the outer condyle of the femur. The middle portion, which is broad and thick, is attached to the back part of the internal tuberosity of the tibia, and sends a very distinct aponeurotic expansion over the popliteus. The inner portion, which is larger and rounded, descends from behind forwards over the internal tuberosity of the tibia, and is inserted into it. It is contained by a fibrous sheath which is lined by a very delicate synovial membrane.

1299. Its *posterior surface* is covered by the biceps and semitendinosus, and by the fascia lata. The *anterior* covers the quadratus, from which it is separated by a mucous bursa, the adductor magnus and internal head of the gatrocnemius, the popliteal artery and the knee-joint. Its *outer edge* is coasted by the sciatic nerve, and concurs with the biceps to form the cavity of the ham. The *inner edge* is partly covered by the gracilis and the fascia lata.

1300. Its uses are the same as those of the preceding muscle.

OF THE BICEPS FEMORIS.

1301. The *Biceps femoris* is also situated at the back part of the thigh. It is simple below, and separated above into two bundles. Of these bundles, one is longer and rounded, and is attached to the upper and outer part of the tuber ischii by a tendon which is common to it and the semi-tendinosus, (1294), and which afterwards degenerates into an aponeurosis extending to the middle of the thigh. This bundle descends from thence outwards, becoming larger, and is confounded with the other bundle, which is shorter, flattened, quadrilateral, broader at the middle than at the extremities, and attached by short aponeuroses, to a large portion of the outer lip of the linea aspera, between the adductor muscles and triceps extensor, from which it is separated by a lamina of the fascia lata. The two portions of the muscle are connected by means of an aponeurosis, commencing very high upon the first, and terminate in a common tendon, which is accompanied very low by the fibres of the second. This tendon bifurcates to be inserted into the top of the fibula, embracing the lower extremity of the external lateral ligament of the knee joint, (717). The anterior branch of this bifurcation, which is smaller than the other, sends off a prolongation which passes over the upper articulation of the tibia and fibula. The posterior branch contributes to the formation of the aponeurosis of the leg.

1302. The *posterior surface* of this muscle is covered by the glutæus maximus and fascia lata. The *anterior* lies upon the semimembranosus, triceps, and adductor magnus muscles, the sciatic nerve, the femur, and the external lateral ligament of the knee. The long portion moreover covers the short, which is applied upon the external superior articular artery, and the external head of the gastrocnemius. Its *inner edge* concurs with the preceding muscle, (1298), to form the ham.

1303. This muscle bends the leg upon the thigh, or the latter upon the leg. Its long portion is capable of extending the thigh upon the pelvis, or of keeping the pelvis erect. It also turns the leg outwards by rotation.

6. *Internal Crural Region.*

OF THE PECTINEUS.

1304. This is an elongated, flat, triangular muscle, broader above than below, situated at the upper and fore part of the thigh. It arises by extremely short aponeuroses, from the upper edge of the pubes, between the spine of that bone and the ileo-pectineal eminence. It descends from thence obliquely outwards and backwards, contracts, and when it has arrived opposite the small trochanter, turns upon itself to be inserted, by means of a flat tendon, which forms sooner before than behind, into the ridge which descends from that process to the linea aspera, immediately beneath the insertion of the psoas magnus and iliacus internus.

1305. Its *anterior surface* is covered by the fascia lata and the crural vessels and nerves. The *posterior* lies upon the body of the pubes, the upper articulation of the femur, the obturator externus and adductor brevis muscles, and the obturator vessels and nerve. Its *inner edge* is a little covered by the long adductor; the *outer* is parallel to the psoas.

1306. The pectineus muscle bends the thigh upon the pelvis. It brings it toward that of the opposite side, or turns it outwards in rotation. It also bends the pelvis upon the thigh or keeps it in its natural position.

OF THE GRACILIS.

1307. The *Gracilis*, which is situated on the inside of the thigh, is a long, flat, thin muscle, broader above than below. It arises, over a space of about two inches, by aponeuroses much longer before than behind, from the anterior surface of the body of the pubes, close to the symphysis, from the ramus of that bone, and from that of the ischium. From thence it descends vertically on the inside of the thigh; contracts rapidly, and when near the knee, is terminated by a slender and rounded tendon, which commences on the posterior edge of the muscle at the middle of the thigh, and which is accompanied anteriorly by fleshy fibres as far as the knee. There it becomes free, passes behind the inner condyle of the femur, enlarges, descends from behind forwards over the upper and inner part of the tibia, unites with the tendon of the semi-tendinosus (1294), and is attached to the bone behind that of the sartorius (1281). By its posterior edge it sends a fibrous expansion to the aponeurosis of the leg.

1308. Its *inner surface* is covered by the fascia lata, and below by the sartorius. The *outer* covers the adductor and semimembranosus muscles, and the internal lateral ligament of the knee joint.

1309. The gracilis bends the leg upon the thigh, or the thigh upon the leg. If the leg is extended, it brings the thigh towards that of the opposite side, &c.

OF THE ADDUCTOR PRIMUS OR LONGUS.

1310. This is a long, flat, thick, triangular muscle, broader below than above, situated before the other two adductors, at the inner and upper part of the thigh. It arises, by a narrow but strong tendon, from the spine, the anterior surface and the symphysis of the pubes. It is prolonged for a long time, under the form of an aponeurosis, over the inner edge of the fleshy body, which descends obliquely outwards and backwards, becoming broader and thicker as far as its middle part, but which then becomes thinner, to terminate between two aponeurotic laminæ uniting into a single one, which is attached to the middle part of the interstice of the linea aspera, over a space of about three inches, between the triceps extensor and adductor magnus, with which it is firmly united. This aponeurosis sends some fibres to the tendon of the latter muscle, which concur, with it, to form an aperture through which the crural artery passes.

1311. The *anterior surface* of the adductor longus is covered by the fascia lata, the sartorius, and the crural artery. The *posterior* covers the other two adductor muscles, and is firmly united to them below. Its *outer edge* is parallel to the pectineus muscle; the *inner* is concealed by the gracilis.

1312. It brings the thigh toward that of the opposite side, bends it a little, and carries it outward in rotation. When one stands upon a single foot, it keeps back the pelvis.

OF THE ADDUCTOR SECUNDUS, OR BREVIS.

1313. Placed behind the preceding muscle, less voluminous than it, elongated, thick, triangular, flattened from within outwards in its upper third, and from before backwards in its two lower thirds; this muscle arises, by short aponeuroses, from almost the whole space which separates the symphysis pubis from the obturator hole, whence it descends outwards and backwards, becoming broader and thinner, to terminate, by a less developed aponeurosis than that of the preceding muscle, and traversed by the perforating arteries, over the middle part of the linea aspera, for a length of about three inches, proceeding from the small trochanter. At this insertion, the adductor brevis is confounded with the adductor longus and adductor magnus, and with the pectineus.

1314. This muscle is covered anteriorly by the preceding, and by the pectineus. Posteriorly, it is applied upon the adductor magnus. Internally, it is connected with the gracilis, and externally with the tendon of the psoas magnus and iliacus internus, and with the obturator externus.

1315. Its uses are the same as those of the preceding muscle.

OF THE ADDUCTOR TERTIUS OR MAGNUS.*

1316. This muscle is triangular, like the other adductors, but is much more voluminous and of greater extent, filling nearly the whole inner and back part of the thigh. It arises, by a broad and thick tendon, which sends an aponeurosis behind its fleshy fibres, from the base of the tuberosity of the ischium, and by short aponeuroses from the bony plate which unites that eminence to the symphysis pubis. The fleshy fibres which arise from these different origins become longer in proportion as they are examined more internally. The upper are nearly transverse, and frequently seem to form a distinct muscle. They come from the bony plate of which we have just spoken, and are attached to the upper fourth of the linea aspera of the femur and to the ridge which unites it to the great trochanter, passing before the rest of the muscle. The middle fibres, which are longer and more oblique, terminate in the three inferior fourths of the linea aspera, by a pretty long aponeurosis, which is confounded with the insertions of the two other adductors, and is perforated by several apertures for the perforating arteries; but, at the end of the linea aspera, it bifurcates in such a manner, that one of its portions ends in a point between the triceps extensor cruris and the short branch of the biceps, while the other proceeds towards a tendon, which terminates the triceps. Between these two portions, there exists an interval which is traversed by the crural arteries and vein, and which represents a sort of entirely fibrous canal. Lastly, the inner fibres, which are very long and nearly vertical, are inserted into a tendon which commences very high upon the inner edge of the muscle, sends a fibrous prolongation before the crural artery, unites with the aponeurosis of the adductor longus, and is attached to the tuberosity of the internal condyle of the femur, where it is confounded with the inner edge of the triceps extensor cruris.

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* Soemmering unites the three adductors under the general name of *Triceps femoris.*

1317. The *anterior surface* of this muscle is covered by the two preceding, by the sartorius, and by the crural artery. The *posterior* covers the semi-tendinosus, semi-membranosus, biceps and glutæus maximus muscles, and the sciatic nerve. The *inner edge*, which is much thicker above than below, is in connection with the fascia lata and the gracilis and sartorius muscles.

1318. This muscle brings the thigh powerfully toward that of the opposite side, keeps the pelvis in its natural position, and has the same uses as the other adductors.

7. *External Femoral Region.*

OF THE TENSOR VAGINÆ FEMORIS, TENSOR FASCIÆ LATÆ.

(*Ilio-aponeurosi-femoral*, Chauss.)

1319. This muscle, which is situated at the upper and outer part of the thigh, is elongated, flattened, broader and thinner below than above, and arises externally from the anterior and superior iliac spine, between the sartorius and glutæus medius, by a very short tendon, more prolonged before than behind. The fleshy fibres descend nearly vertically, diverging as they proceed, and about three inches above the great trochanter terminate in a separation of the two laminæ of the crural aponeurosis or fascia lata.

1320. Its *outer surface* is covered by a thin lamina of the fascia lata. The *inner* is separated by another from the rectus femoris and triceps extensor cruris. It also covers a little the glutæus medius and glutæus minimus. Its *anterior edge* is parallel above to the sartorius, and separates from it below. The *posterior* is united above to the glutæus medius.

1321. This muscle rotates the thigh inwards. It also carries it outwards, separating it from the other. Its principal action, however, is to stretch the aponeurosis by which the muscles of the thigh are enveloped.

B. MUSCLES OF THE LEG.

1. *Anterior Region of the Leg.*

OF THE TIBIALIS ANTICUS.

1322. The *tibialis anticus* is a long, thick, fleshy muscle, of the form of a triangular prism above, slender and tendinous below.

It arises from the external tuberosity and upper half of the outer surface of the tibia by short aponeurotic fibres, from the upper and fore part of the interosseous ligament, from an aponeurotic partition which separates it from the extensor digitorum, and from the upper part of the inner surface of the aponeurosis of the leg. From these origins it descends obliquely inwards and forwards, becoming at first a little thicker and then diminishing; and when it has arrived below the middle third of the leg, it terminates by a flat and pretty strong tendon, which existed for a long time among the fleshy fibres and upon their anterior surface, and into which they are inserted like the barbs of a feather into its shaft. This tendon descends before the anterior extremity of the tibia, passes over the ankle joint, is engaged in a sort of groove of the anterior annular ligament of the tarsus, where it is invested by a small synovial bursa, proceeds from behind forwards and from without inwards over the back of the foot, becomes broader, and arrives at the inner side of the first cuneiform bone, where it divides into two portions. Of these portions the posterior, which is larger, slides over the bone by means of a small synovial membrane, and is inserted at its base; while the other, which is anterior and smaller, is attached to the inner and lower part of the posterior extremity of the first metatarsal bone.

1323. The *anterior surface* of this muscle is covered by the tibial aponeurosis to which it adheres above, by the annular ligament of the tarsus, and by the dorsal aponeurosis of the foot. The *inner surface* is applied upon the outer surface of the tibia; the *outer* corresponds to the extensor communis digitorum above, and the extensor proprius pollicis below, from which it is separated posteriorly by the anterior tibial nerve and vessels. Its *posterior edge* covers the interosseous ligament, the tibia, the tibio-tarsal articulation, and the upper and inner part of the tarsus.

1324. The tibialis anticus bends the foot upon the leg, and directs its point inwards at the same time that it raises its inner edge. It also bends the leg upon the foot, and prevents it from falling backwards in the standing posture.

OF THE EXTENSOR PROPRIUS POLLICIS PEDIS.

1325. This muscle is fleshy, broad, thick, and transversely flattened above, slender and tendinous below, and is situated to the outside of the preceding. It arises, by short aponeuroses, from the fore part of the inner surface of the fibula, over an extent of five or six inches proceeding from the lower part of its upper third, and from the neighbouring region of the interosseous ligament (730). From thence, the fleshy fibres descend forwards parallel to each other, forming a bundle which is broader in the middle than at its extremities. They are all about two inches in length, and terminate successively upon a tendon which separates from them toward the ankle, passes into a particular groove beneath the annular ligament of the tarsus, runs along the inner edge of the foot, slides over the first phalanx of the great toe, with which it is connected by two fibrous expansions, and is at length inserted into the last phalanx, over which it is expanded. This tendon, which is broader near its insertion and upon the tarsus than in the rest of its passage, is surrounded by a synovial capsule at the moment of its passing under the annular ligament.

1326. The *inner surface* of this muscle corresponds to the tibialis anticus, and to the anterior tibial nerve and vessels. The *outer surface* is applied against the extensor communis digitorum. Its *anterior edge* is concealed above between the tibialis anticus and extensor digitorum, and is covered below by the tibial aponeurosis and the skin. The *posterior edge* lies upon the fibula, the interosseus ligament, the tibia, the anterior tibial artery, the tibiotarsal articulation, and the back of the foot and great toe.

1327. This muscle extends the last phalanx of the great toe upon the first, and the latter upon the first metatarsal bone. It also bends the foot upon the leg, or the leg upon the foot.

OF THE EXTENSOR LONGUS COMMUNIS DIGITORUM PEDIS.

1328. Elongated, thin, transversely flattened, simple and fleshy above, divided into four tendons below, this muscle arises from the external tuberosity of the tibia, between the tibialis anticus and peroneus longus, from the two aponeurotic partitions which separate them from each of these muscles, from the anterior ligament of the upper articulation of the tibia and fibula, (727) from the interosseous ligament, from the fore part of the fibula over a space of five or six inches, and from the tibial aponeurosis at the upper part of its inner surface. The fleshy fibres proceeding from these different insertions follow various directions. The upper are vertical, the lower more and more oblique. They form a mass which descends obliquely inwards, and which is larger in the middle than at its extremities. They are all inserted into a tendon which is at first concealed in their substance, and which appears upon their inner surface about the middle of the leg, being accompanied by them posteriorly as far as the annular ligament of the tarsus. Long before arriving there, the fleshy fibres and the tendon are divided into three contiguous portions, which pass beneath it in a groove invested with a very distinct synovial capsule, and which is common to them with the tendon of the peroneus tertius (1331.) At this moment, the inner portion bifurcates, so that upon the back of the foot there are perceived four tendons which separate from each other, directing themselves toward the four last toes, and crossing the direction of the extensor brevis digitorum. The inner is obviously stronger than the others, and the outer frequently receives a fibrous prolongation from the tendon of the peroneus brevis. Arrived upon the upper surface of the phalanges, the first three are united with the inner edge of the tendons of the extensor brevis digitorum, and they are all strengthened by a prolongation of the tendons of the lumbricales and interossei. They then become broader and form a sort of aponeurosis which covers the whole upper surface of the toes, dividing and terminating precisely in the same manner as the tendons of the extensor communis digitorum manus (1186.)

1329. The *anterior edge* of this muscle is covered by the tibial aponeurosis to which it adheres above, the annular ligament of the tarsus, and the skin. The *posterior* covers the fibula, the interosseous ligament, the tibia, the ankle-joint, the extensor brevis digitorum, and the toes. The *inner* corresponds to the tibialis anticus and extensor proprius pollicis, and is united above with the former. The *outer* is confounded above with the peroneus longus, at the middle with the peroneus brevis, and below with the peroneus tertius.

1330. It extends the three phalanges of the last four toes, and bends the foot on the leg, or the leg on the foot.

OF THE PERONEUS TERTIUS.

1331. This muscle does not exist in all subjects. It is situated at the anterior and inferior part of the leg, and is of an elongated form, thin and compressed. It arises from the lower third of the fore part of the fibula, the interosseous ligament, and an aponeurotic partition which separates it from the peroneus brevis. From thence it descends a little inwards, confounded in a great part of its extent with the preceding muscle, and degenerates into a tendon which lies at first upon its anterior surface, then separates, passing under the annular ligament of the tarsus, in the same groove with those of the extensor communis, crosses the course of the extensor brevis digitorum pedis, becomes broader, and is converted into an aponeurosis which is inserted at the outer edge of the posterior extremity of the fifth metatarsal bone, and into the neighbouring part of its body, sending a prolongation to the outer tendon of the preceding muscle.

1332. The *outer surface* of this muscle, which is directed a little forwards, is covered by the aponeurosis of the leg. The *inner surface* is confounded with the extensor communis digitorum. It covers in the foot the extensor brevis digitorum pedis and the first metatarsal bone. Its *posterior edge* is applied upon the fibula and interosseous ligament, and is united with the peroneus brevis.

1333. It bends the foot upon the leg, raising its outer edge. It also bends the leg on the foot.

2. *Posterior and Superficial Region of the Leg.*

OF THE TRICEPS EXTENSOR PEDIS.

1334. The *Triceps Extensor pedis* is an extremely large and strong muscle, of which the *calf of the leg* is principally formed. It is simple below, where it presents the strongest tendon in the body; but, at its upper part, is formed of three fleshy bellies. Of these, the two posterior are called *Gastrocnemii* or *Gemelli* by most anatomists; the anterior or deep-seated is their *Soleus*.

1335. Of the *Gastrocnemii*,* or *Gemelli*. These are two fleshy masses resembling each other in form, separated above, and united below by means of a common aponeurosis. Their direction is nearly vertical, and their form approaching to elliptical. They are convex behind, flat before. The inner is always larger, and descends lower than the outer. The latter, which bears the name of *Gastrocnemius externus* arises from the back part of the outer condyle of the femur, by a pretty strong tendon which descends on the outer edge of the muscle over an extent of about two inches, and then degenerates into an aponeurosis which descends very low upon its posterior surface. The inner or *Gastrocnemius internus* arises from the back and upper part of the inner condyle of the femur, by a broader and thicker tendon, which descends upon its inner edge, and becomes, in like manner, converted into an aponeurosis. The fleshy fibres arise from these two tendons and their aponeuroses. They are rather short, pass obliquely downwards and forwards, and terminate successively on the posterior surface of a broad aponeurosis, which is at first divided so as to correspond to each bundle, and then becomes simple, and unites them with each other and with the soleus, but much sooner externally than internally.

1336. By their separation, the two gastrocnemii contribute to the formation of the hollow of the ham. The inner is covered above by the semi-membranosus, and in the rest of its extent by the aponeurosis of the leg, which entirely covers the outer. Their *anterior surface* is applied above upon the condyles of the femur, and the synovial membrane of the knee-joint, which lines their tendons a little. The outer is in connection at this place with the popliteus, and the inner with the semi-membranosus, from which it is separated by a small synovial bag of an oval form, and plentifully supplied with moisture, the popliteal artery, and the popliteus and plantaris muscles. In the rest of its extent, the anterior surface of the gastrocnemii lies upon the soleus.

1337. *Of the Soleus.*† It is broad and thick in the middle, contracted at the extremities, and of an oval form. Three distinct aponeuroses give rise to its fleshy fibres, which are very numerous. The first, which is broad and thin, is attached to the upper extremity of the fibula, and to its outer edge. It descends very low upon the outer edge of the anterior surface of the muscle. The second is a kind of fibrous arch whose convexity is directed downwards, and under which pass the popliteal vessels. It unites the preceding aponeurosis to the third, which is attached to the posterior oblique line of the tibia and the middle third of the inner edge of that bone, and which is expanded over the inner and fore-part of the muscle. From these origins, the fleshy fibres descend in a converging manner, and terminate successively at the fore-part of a broad and thin aponeurosis which extends over their posterior surface, almost from their upper extremity, and which sends into their interior a sort of fibrous partition or raphe, into which they are inserted, like the barbs of a feather into the shaft. Inferiorly, this aponeurosis unites with that of the gastrocnemii, and contributes to form the tendo Achillis.

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* Γαστὴρ, venter; *κνὴμη, crus.*

† *Solea*, sole, a species of flounder.

1338. The *posterior surface* of the soleus is covered by the gastrocnemii and plantaris, and by the aponeurosis of the leg. Its *anterior surface* covers the peroneus longus, popliteus, flexor longus digitorum, flexor longus pollicis, and tibialis posticus muscles, a portion of the posterior surface of the fibula, and the popliteal, posterior tibial, and fibular vessels.

1339. Of the *Tendo Achillis.* It results from the union of the inferior aponeurosis of the three fleshy masses which we have just described. Narrower and more rounded in the middle than at its extremities, broader at its upper than at its lower part, formed of very distinct fibres, it descends vertically behind the lower part of the leg, where it forms a remarkable prominence. It slides over the upper half of the posterior surface of the calcaneum, by means of a cartilaginous surface and a synovial capsule, and is inserted into its lower half. It is covered *posteriorly* by the skin. *Anteriorly,* it is separated from the muscles of the posterior and deep region of the leg by a great quantity of cellular tissue, and it receives fleshy fibres from the soleus until near the calcaneum.

1340. The triceps muscle extends the foot upon the leg, and the leg upon the foot. By means of its two superficial bellies, it can bend the leg and the thigh on each other.

OF THE PLANTARIS.

1341. This muscle, which is wanting in some subjects, is long, thin, narrow, and extremely slender. It arises by a small tendon, behind the outer condyle of the femur, from the posterior ligament of the knee joint, and from the tendon of the gastrocnemius externus. It forms behind the joint a small fusiform fleshy bundle, rounded and conical, which descends obliquely inwards, and which after passing along a space of two or three inches, terminates in a thin and narrow tendon, which passes between the soleus and gastrocnemii, and about the lower third of the leg, adheres to the inner side of the tendo Achillis, which it accompanies to the calcaneum, where it is inserted by expanding.

1342. Its *posterior surface* is covered by the gastrocnemii and the skin; the *anterior* is applied upon the knee-joint, its posterior ligament (719), the popliteal vessels, and the popliteus and soleus muscles.

1343. This muscle extends the foot on the leg, or the leg on the foot. It may also contribute to bend the leg on the thigh.

OF THE POPLITEUS.

1344. This muscle is situated at the upper and back part of the leg, and behind the knee-joint. It is short, flat, nearly triangular, and arises, by a thick and strong tendon, upwards of an inch in length, from a depression that is observed upon the tuberosity of the outer condyle of the femur, beneath the attachment of the external lateral ligament of the knee-joint. This tendon, which is embraced anteriorly by the synovial membrane of that articulation, adhering to the external semilunar cartilage, is converted into an aponeurosis which descends for some time on the fore part of the muscle, and is afterwards concealed among its fleshy fibres. The latter, which are so much the longer and more oblique the lower they are, and are directed downwards and inwards, terminate on the posterior and superior triangular surface of the tibia, and on the inner edge of that bone, as well as on a thin aponeurosis, detached from the tendon of the semi-membranosus (1297), and which covers the popliteus itself posteriorly.

1345. The *posterior surface* of this muscle is covered by the gastrocnemii and plantaris muscles, the popliteal vessels, and the posterior tibial nerve. The *anterior* is applied upon the articulation of the tibia and fibula, the tibialis posticus muscle, and the tibia. Its *outer edge*, which is longer than the inner, is connected above by a thin membrane with the upper part of the fibula and the soleus.

1346. This muscle bends the thigh and the leg upon each other, and draws the point of the foot inwards, making the tibia turn upon its axis.*

3. *Posterior and Deep Region of the Leg.*

OF THE FLEXOR COMMUNIS LONGUS DIGITORUM PEDIS.

1347. This muscle, which is extended at the back part of the leg and beneath the foot, is long, flat, broader in the middle than at its extremities, fleshy and simple above, and terminated by four tendons below. It arises from the posterior surface of the tibia, extending from its upper oblique line to three fourths down, and from an aponeurotic partition which is common to it with the tibialis posticus and flexor longus pollicis. From thence it descends obliquely inwards, at first increasing a little in size, and then diminishing. Its fleshy fibres are all inserted in succession upon the sides of a tendon which prevails for some time internally and posteriorly, and which toward the lower part of the leg is abandoned by them. The tendon then passes behind the malleolus internus, in a groove which is common to it and that of the tibialis posticus, from which it is however separated by a fibrous septum, and behind which it is placed. These two tendons are kept down in this place by a sort of ligamentous sheath, fixed to the groove of the tibia, the malleolus internus, the astragalus, and under the small tuberosity of the calcaneum. Internally of this sheath, two distinct synovial capsules are met with, one for each tendon. The whole apparatus is continued under the arch of the calcaneum, where the tendon sinks to advance again obliquely from behind forwards and from within outwards, under the arch of the foot, crossing at first the direction of the flexor longus pollicis, under which it lies, and communicating with its tendon by a fibrous slip. There it begins to become broad, and to present traces of four divisions; and there also it gives attachment to its accessory muscle. Farther on, it divides into four tendons, thin and slender compared with the size of the toes to which they belong, which separate from each other, give origin to the lumbricales muscles, issue from above the plantar aponeurosis opposite the articulations of the metatarsal bones and phalanges, enter beneath the toes into a fibrous sheath precisely similar to that of the fingers (1175), and which also receives the tendons of the extensor brevis digitorum pedis, pass through these tendons in slits formed opposite the middle of the first phalanges, and are attached to the posterior and inferior parts of the third phalanges of the last four toes.

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* Winslow affirms that the popliteus does not assist in bending the knee-joint; of the correctness of this opinion every anatomist may judge, by comparing what I have said when describing the anatomy of the thigh-bone, with the reasons assigned by that great anatomist in his "Anatomical Exposition."

1348. In the leg, the *posterior surface* of this muscle is covered by the soleus muscle, the tibial aponeurosis, and the posterior tibial artery. The *anterior* covers the tibia and the tibialis posticus muscle. Its *outer edge* is connected with that muscle, and with the flexor proprius pollicis. In the foot, it is in connection, by the *inferior surface* of its tendons, with the adductor pollicis, flexor brevis digitorum, and abductor minimi digiti muscles, and with the plantar nerve; and by the *upper surface*, with the deep-seated muscles of the sole of the foot.

1349. Its uses are to bend the three phalanges on each other, and the toes on the metatarsus, and to extend the foot on the leg. It acts much in standing.

OF THE TIBIALIS POSTICUS.

1350. Elongated, flat, much thicker above than below, and somewhat of the form of a triangular prism, this muscle bifurcates at its upper part to allow a passage to the anterior tibial vessels. The outer and smaller branch of this bifurcation, arises from the inner and back part of the fibula; the other, which is larger, is attached to the oblique line of the tibia, to its posterior surface, and to the interosseous ligament. From thence the muscle descends at first nearly vertically and afterwards a little inwards, successively receiving fibres which come from an aponeurotic septum placed between it and the flexor communis digitorum and flexor proprius pollicis. It increases in size to its middle part, and diminishes farther down. It terminates at length by a tendon which commences pretty high upon its inner and fore side, and which, after becoming free, passes into the groove formed behind the malleolus internus, as we have already mentioned (1347,) where it increases much in breadth, to be inserted at the lower and inner part of the os scaphoides, and by a prolongation into the base of the first cuneiform bone. The portion of this tendon which passes under the head of the astragalus contains a sesamoid bone.

1351. The *anterior surface* of this muscle covers the fibula, the tibia, a large extent of the interosseous ligament, and the inferior calcaneo-scaphoid ligament (751.) The *posterior surface* is covered by the soleus, flexor longus digitorum, and flexor proprius pollicis muscles, and by the malleolar fibrous sheath (1347.)

1352. It extends the foot upon the leg, raising its inner edge. It also extends the leg upon the foot.

OF THE FLEXOR LONGUS POLLICIS.

1353. Fleshy, thick and flattened above, of the form of a triangular prism in the middle, slender and tendinous below, and situated at the back part of the leg and the under part of the foot, this muscle arises from the two lower thirds of the posterior surface of the fibula, from the interosseous ligament, and from two aponeurotic partitions which separate it from the two preceding muscles on the one hand, and on the other from the peroneus longus and peroneus brevis. It descends vertically behind the fibula, becoming larger as far as its middle, and then contracting again. Arrived at the lower part of the leg, it terminates by a tendon at first concealed among its fleshy fibres until opposite the ankle joint. There, it becomes nearly horizontal, enters a groove formed behind the inferior extremity of the tibia, (511) and the posterior surface of the astragalus, (521), where it is kept down by a ligamentous sheath which is lined by a synovial bursa, and which accompanies it under the arch of the calcaneum in a particular depression. It is there placed to the outer side of the tendon of the flexor communis digitorum. This tendon, which was at first broad, becomes narrower as it leaves the fleshy fibres, passes under that of the flexor communis, communicates with it, (1347,) proceeds over the inner edge of the foot between the two portions of the flexor brevis pollicis, passes between the two sesamoid bones of the first articulation of the metatarsal bones and phalanges, opposite which it enlarges, to penetrate into the fibrous sheath of the great toe, which is similar to that of the thumb (1191,) and in which it is enveloped by a synovial membrane. At the entrance of this sheath, it contracts, presents traces of a longitudinal division, and is expanded at its extremity, which is attached to the lower and posterior part of the last phalanx of the great toe.

1354. In the leg, the *posterior surface* of this muscle is covered by the soleus and by the tibial aponeurosis. The *anterior* is applied upon the fibula, the tibialis posticus and flexor longus communis muscles, the interosseous ligament and the tibia. Its tendon is surrounded by synovial membranes behind the ankle joint and under the great toe, and by the flexor brevis pollicis under the sole of the foot.

1355. This muscle bends the second phalanx of the great toe upon the first, and the latter upon the corresponding metatarsal bone. It increases the concavity of the sole of the foot, and extends the foot and the leg upon each other.

4. *Peroneal Region.*

OF THE PERONEUS LONGUS.

1356. The *Peroneus longus* is placed at the outer part of the leg and under the sole of the foot. It is very long and narrow, fleshy and of the form of a triangular prism above, terminated below by a slender tendon. It arises from the upper part of the tibial aponeurosis, the upper third of the outer surface of the fibula, a small part of the tibia, two aponeurotic partitions which are placed between it and the soleus and flexor longus pollicis, on the one hand, and the extensor communis digitorum on the other. It descends at first a little obliquely backwards, enlarging in the middle, and is terminated by a tendon which commences very high upon its outer and anterior side, and only becomes free about two thirds down the leg. This tendon continues to run along the fibula, directing itself however a little backwards, and behind the external malleolus enters a groove which is common to it with that of the peroneus brevis, and in which it is kept down by a ligamentous bridle. The synovial capsule which it contains is common to the two tendons, to the ligamentous bridle itself, the inner surface of the external lateral ligament (740), and the groove of the fibula. Beneath the malleolus it quits the tendon of the peroneus brevis, and passes into a groove of the outer surface of the calcaneum, where it is again kept down by a particular fibrous sheath, but is lined by the same synovial membrane, which forms a cul-de-sac towards the os cuboides. It then turns over the side of that bone, penetrates into the deep groove which it presents, and is there bound down by another ligamentous sheath, which also contains a distinct synovial membrane. It then directs itself inwards and forwards, and is inserted upon the inner and outer part of the posterior extremity of the first metatarsal bone. A sesamoid bone is often met with in its substance, to the outside of the os cuboides, and another is occasionally observed behind the malleolus externus, or along the calcaneum.

1357. In the leg, the *outer surface* of the peroneus longus is covered by the tibial aponeurosis; the *inner* is applied upon the fibula, and the extensor digitorum communis and peroneus brevis; the *posterior* corresponds above to the soleus, and is united below to the flexor longus pollicis. The various relations of this tendon have already been sufficiently noticed.

1358. It extends the foot on the leg, turning its point outwards, and raising its inner edge. It also acts upon the leg, which it extends upon the foot.

OF THE PERONEUS BREVIS.

1359. It has the same form as the preceding muscle, but is not so long. It arises, by short aponeuroses, from the lower half of the outer surface of the fibula, and from two aponeurotic partitions, which separate it anteriorly from the peroneus tertius and extensor communis digitorum, and posteriorly from the flexor longus digitorum. It descends a little obliquely outwards, and, at the lower part of the foot, degenerates into a tendon which had commenced very high upon its outer side. Behind the malleolus externus, the tendon enters a groove which is common to it and the peroneus longus (1357), and in passing through it becomes broader. On emerging, it contracts, becomes rounded, leaves the tendon of the peroneus longus, passes above it over the outer surface of the calcaneum, where it is separated from it by a fibrous partition, becomes broad a second time and is inserted at the upper part of the posterior extremity of the fifth metatarsal bone, frequently sending a prolongation to the tendon of the extensor tendon of the little toe.

1360. Its *outer surface* is covered by the peroneus longus and tibial aponeurosis. The *inner* covers the fibula, and corresponds to the extensor digitorum communis and peroneus tertius, and at its lowest part to the flexor longus pollicis. The synovial membrane which envelopes its tendon and that of the preceding muscle behind the malleolus, is prolonged into the particular sheath which contains it alone at the level of the calcaneum, so that it seems bifurcated at its lower part.

1361. It extends the leg and foot mutually upon each other, raising the outer edge of the latter a little.

C. MUSCLES OF THE FOOT.

1. *Dorsal Region of the Foot.*

OF THE EXTENSOR BREVIS DIGITORUM PEDIS.

1362. This is a broad flat muscle, thin and fleshy behind, terminated anteriorly by four tendons. It arises from the upper surface of the calcaneum, before the groove which lodges the tendon of the peroneus brevis, from the external ligament of the calcaneum and astragalus (749), and from the annular ligament of the tarsus (1397), proceeds forwards and inwards, increasing in breadth, and soon divides into four portions, of which the two inner are larger and shorter. Each of these portions is terminated by a thin and flat tendon, at first concealed among the fleshy fibres, but afterwards isolated. These tendons cross the direction of those of the extensor longus, passing under them, and traversing the metatarsus obliquely. The first, on arriving at the articulation of the metatarsus with the phalanx of the great toe, becomes broader and is inserted at the upper part of the posterior extremity of its first phalanx. The other three pass over the upper surface of the first phalanges of the second, third and fourth toes, and join the outer edge of the tendons of the extensor longus muscle to terminate along with them. (1328).

1363. The *upper surface* of this muscle is covered by a very thin aponeurotic lamina, extended over the back of the foot, and by the tendons of the extensor longus digitorum pedis. The *inferior surface* covers the tarsus, the metatarsus, the interossei dorsales muscles, and the phalanges.

1364. It extends the first four toes, and directs them a little outwards.

2. *Middle Plantar Region.*

OF THE FLEXOR BREVIS DIGITORUM PEDIS.

1365. This is a flat elongated muscle, much narrower and thicker behind than before, where it is divided into four portions. It arises from the posterior and inferior part of the calcaneum, between the adductor pollicis and abductor minimi digiti, from which it is separated by two aponeurotic partitions. Some of its fibres also arise from these partitions, as well as from the plantar aponeurosis. From thence it directs itself forwards, increases at first in size, then diminishes, and at the middle of the sole of the foot, divides into four distinct bundles, of which the inner are the largest. These bundles successively cover each other from within outwards, and are each terminated by a tendon, which appears sooner above than below. These tendons advance beneath the heads of the metatarsal bones, pass between the slips of the plantar aponeurosis, are engaged along with those of the flexor longus in the fibrous sheath placed under the toes, split to allow them to pass (1347), exactly in the same manner as those of the flexor sublimis of the fingers (1173), and are inserted, by two slips, upon the sides of the second phalanx of each of the last four toes.

1366. Its *inferior surface* covers the plantar aponeurosis, with which it is intimately connected behind. The *upper surface* is covered by the lumbricales and accessory muscle of the flexor longus, by the plantar vessels and nerves, and by the tendons of the flexor longus. Its *inner edge* is connected posteriorly with the adductor pollicis, from which it is separated anteriorly by the tendon of the flexor longus, and by a portion of the flexor brevis of the great toe. The *outer edge* is united posteriorly with the abductor minimi digiti, and is contiguous anteriorly to the flexor brevis minimi digiti.

1367. It bends the second phalanges of the toes upon the first, and these upon the metatarsal bones. It also augments the concavity of the arch of the foot.

OF THE MUSCULUS ACCESSORIUS.

1368. It is situated at the back part of the sole of the foot, and is of a quadrilateral form, flat and thin. It arises by means of aponeurotic fibres, and by two distinct bundles, from the lower and inner surface of the calcaneum, whence it proceeds forwards and a little outwards, in a horizontal direction. Its fibres, which are all parallel, terminate on the outer and upper part of the tendon of the flexor longus digitorum pedis, near the point where it divides. They frequently present there an aponeurosis prolonged upon the inner edge, while the aponeurosis by which they are attached to the calcaneum is more distinct at their outer edge. Its *inferior surface* covers the adductor pollicis, flexor brevis digitorum, and abductor minimi digiti, as well as the plantar vessels and nerves. The *upper surface* is covered by the calcaneum, the inferior calcaneo-cuboid ligament (758), and by the extremity of the abductor minimi digiti.

This muscle serves as an auxiliary to the flexor longus, and rectifies its obliquity.

OF THE LUMBRICALES.

1369. Similar in form, number, and disposition to those of the hand (1242), these four small muscles extend from the tendons of the flexor longus to the last four toes. The first, which is the longest and largest, arises from the inner edge and upper surface of the flexor tendon of the second toe; the other three, which diminish successively in volume from within outwards, arise from the interval which the four tendons of the flexor longus leave between them at the moment of their separation. They all proceed horizontally forwards, diverging a little, and terminate each by a tendon, appearing at first on one of their surfaces and afterwards becoming isolated, which passes between the slips of the plantar aponeurosis, runs along the inner edge of the last four metatarso-phalangeal articulations, and is at length inserted into the inner and lower part of the base of the first phalanx of each of the last toes, sending a thin aponeurosis to their extensor tendon, in the same manner as in the hand (1242).

1370. Their *inferior surface* covers the plantar aponeurosis. The *upper* lies beneath the oblique and transverse abductors of the great toe, and the interossei plantares.

1371. They carry the toes a little inwards, and contribute to bend the first phalanges, and to extend the second and third.

3. *Internal Plantar Region.*

OF THE ADDUCTOR POLLICIS PEDIS.*

1372. This muscle is situated at the inner part of the sole of the foot. It is long, flat, larger posteriorly than anteriorly, and arises from the posterior, internal, and inferior part of the calcaneum, by pretty distinct aponeuroses, especially above; from an aponeurotic partition which separates it from the flexor brevis digitorum; from the internal annular ligament of the tarsus, and from the posterior part of the plantar aponeurosis. From these different origins, the fleshy fibres proceed forwards and a little inwards, and are inserted successively and very obliquely upon the upper surface of a tendon which they conceal for some time, which afterwards appears beneath them, unites with the inner portion of the flexor brevis (1375), and, as it were, without having been isolated from them, is attached to the lower and inner part of the base of the first phalanx of the great toe, adhering strongly to the ligaments by which it is connected with the first metatarsal bone.

1373. Its *inferior surface* covers the plantar aponeurosis, to which it intimately adheres behind. The *upper surface* is covered by the accessorius and flexor brevis pollicis muscles, the tendons of the flexor longus digitorum, flexor longus pollicis, tibialis anticus, and tibialis posticus, and by the plantar vessels and nerves.

1374. It carries the great toe inwards, and bends it a little.

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* *Abductor* of most British writers.

OF THE FLEXOR BREVIS POLLICIS PEDIS.

1375. Short, thin, and narrow posteriorly, broad, thick, and bifurcated anteriorly, this muscle is situated externally of the preceding. It arises from the anterior and inferior part of the calcaneum, and from the last two cuneiform bones and their ligament, by a pretty thick tendon, at least an inch in length, and which extends nearly over the whole of its upper surface. Several of these fibres also arise from the aponeurotic partition which separates it from the adductor pollicis (1373). They are all short and oblique, and advance a little inwards, forming a bundle which increases in size, presents at its under surface a groove for lodging the tendon of the flexor longus pollicis (1354), and divides into two portions, at first united by cellular tissue, and afterwards isolated. Near the anterior extremity of the first metatarsal bone, the outer unites with the tendon of the preceding muscle, terminates along with it at the first phalanx of the great toe, and is moreover attached to the inner sesamoid bone of the articulation. The outer portion, which is thinner, and confounded with the abductor * pollicis, is inserted along with it into the lower and outer part of the base of the first phalanx of the great toe, and the outer sesamoid bone (543).

1376. Its *inferior surface* rests upon the tendon of the flexor longus pollicis, the plantar aponeurosis, and the adductor pollicis, with which it is partly confounded. The *upper surface* has above it the tendon of the peroneus longus and the first metatarsal bone. Its *outer edge* is united anteriorly with the abductor pollicis.

1377. It bends the first phalanx of the great toe upon the first metatarsal bone.

OF THE ABDUCTOR POLLICIS.*

1378. This muscle is situated to the outside of the preceding, at the middle and anterior part of the sole of the foot. It is short, thick, and of the form of a triangular prism. It arises by very distinct aponeurotic fibres, from the inferior surface of the os cuboides, from the ligamentous sheath of the peroneus longus, and from the posterior extremity of the third and fourth metatarsal bones, as well as from the ligaments by which they are connected. Increasing at first in size, and then diminishing, it proceeds from thence forwards and inwards, is confounded with the outer portion of the preceding muscle (1375), and, a little farther on, with the transversus pedis (1381), to be attached along with them to the outer and under part of the first phalanx of the great toe and its outer sesamoid bone, by an aponeurosis which occupies its inferior surface.

1379. Its *inferior side* covers the flexor longus digitorum, the accessorius muscle, the lumbricales, and the plantar aponeurosis. The *inner side* corresponds to the flexor brevis pollicis, the tendon of the peroneus longus, and the outer edge of the metatarsal bone. The *outer edge* is in connection with the interossei and external plantar artery.

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* *Adductor* of British writers.

1380. It carries the great toe outwards, and bends it a little.

OF THE TRANSVERSUS PEDIS.

1381. This muscle is thin, long, and flat, and extends transversely beneath the heads of the first four metatarsal bones. It is about an inch in breadth, and arises, by distinct and fasciculated aponeurotic fibres, from the ligaments of the last four metatarso-phalangeal articulations. There result from this four small parallel slips, more distinct behind than before, which unite together, and are attached, along with the preceding muscle, to the outer edge of the base of the first phalanx of the great toe. Its *inferior surface* covers the tendons of the flexor longus and flexor brevis digitorum, the lumbricales, and the collateral nerves and vessels of the toes. The *upper surface* corresponds to the interossei.

This muscle carries the great toe outwards, and brings nearer to each other the heads of the metatarsal bones.

4. *External Plantar Region.*

OF THE ABDUCTOR MINIMI DIGITI.

1382. It lies beneath the outer edge of the foot, and is long, flat, and broader and thicker posteriorly than anteriorly. It arises from the inferior surface of the calcaneum, on the outside of the flexor brevis communis, by short aponeurotic fibres; from a fibrous partition which separates it from the flexor brevis digitorum; from the plantar aponeurosis, and from the posterior extremity of the fifth metatarsal bone, by a kind of tendon, which is continuous with that aponeurosis. From thence, it advances beneath the inferior surface of that bone, diminishing in size. Its fibres then terminate successively upon a tendon which they conceal posteriorly, which then extends over the upper and inner surface, separated from them towards the head of the fifth metartarsal bone, and is inserted into the outside of the corresponding extremity of the first phalanx of the little toe.

1383. Its *inferior surface* covers the plantar aponeurosis, to which it is strongly united behind. The *upper* is covered by the accessorius muscle, the inferior calcaneo-cuboidal ligament, the tendon of the peroneus longus, the posterior extremity of the fifth metatarsal bone, and the flexor brevis minimi digiti, which is seen anteriorly between its *inner edge* and the flexor brevis communis, which is united to it behind.

1384. It carries the little toe downwards, and bends it a little.

OF THE FLEXOR BREVIS MINIMI DIGITI.

1385. Short, thicker in the middle than at its extremities, and situated internally of the preceding, this muscle arises, by aponeuroses prolonged over its inner surface, from the under part of the posterior extremity of the fifth metatarsal bone, and from the ligamentous sheath of the tendon of the peroneus longus. From thence it directs itself horizontally forwards, and is inserted, by aponeurotic fibres appearing upon its under surface, into the lower and outer part of the base of the first phalanx of the little toe. Its *inferior surface* covers the plantar aponeurosis and the abductor minimi digiti. The *upper surface* is covered by the fifth metatarsal bone and by the last plantar interosseous muscle. It bends the first phalanx of the little toe.

5. *Interosseous Region.*

OF THE INTEROSSEI PEDIS.

1386. The *interossei* of the foot are similar in their number, form, and disposition to those of the hand (1245.) Six belong to the three middle toes, and one to the little toe. The great toe has none. As in the hand, we also distinguish them, for each toe, into abductors and adductors. Four are situated on the back of the foot, and three on the sole.

1387. *Interossei of the second toe.* The *adductor* is the largest of the interossei of the foot. Its form is that of a triangular prism. It is dorsal, and arises from the whole extremity of the inner side of the second metatarsal bone, and from the outer side of the posterior extremity of the first. The latter portion is separated from the first by an interval in which passes the anterior tibial artery. Its fleshy fibres are attached to the two sides of a tendon concealed in their substance, and which they accompany to the extremity of the tarsus. This tendon is partly inserted into the inner edge of the base of the first phalanx of the second toe, and partly upon the corresponding extensor tendon. Its *upper surface* is covered by the skin. The *inferior* corresponds to the abductor pollicis; and its *sides* are applied upon the first two metatarsal bones. The *abductor* is also dorsal and of the same form. It arises from the whole outer side of the second metatarsal bone and from the upper part of the inner side of the third. It is terminated by a tendon, which has the same insertions on the outer side of the second toe, as the adductor on the inner. Its *upper surface* is covered by the skin, by a thin aponeurosis which goes from the second to the third metatarsal bone, and by the extensor tendons of the toes. The *lower surface* corresponds to the abductor pollicis.

1388. *Interrossei of the third toe.* The *adductor* is plantar, and as the third and second metatarsal bones are very close to each other, it is rather situated above them than in their interval. Its form is that of a triangular prism. It arises from the two lower thirds of the whole inner surface of the third metatarsal bone, and from the ligaments by which they are united inferiorly to the tarsus. Its fleshy fibres are inserted upon the outer surface and a little upon the inner edge of a tendon which terminates, like those of the preceding muscles, at the inner side of the third toe. The *upper side* of this muscle is placed between the third metatarsal bone and the abductor of the second toe. The *lower side* is applied upon the transversus pedis and abductor pollicis. The *abductor* of the third toe is dorsal, and larger than its adductor. It arises from the whole outer side of the third metatarsal bone, from the upper part of the inner side of the fourth, and from the ligaments by which they are united, and terminates by a tendon precisely similar to those of the other interossei. Its *upper surface* is covered by an aponeurosis which goes from the third to the fourth metatarsal bone. The *lower* covers the transversus pedis and the tendons of the flexor muscles.

1389. *Interossei of the Fourth Toe.* The *adductor* is plantar. It is flattened, and situated beneath the interosseous space to which it belongs. It arises from the lower part of the inner surface of the fourth metatarsal bone, and from the ligaments by which it is connected with the tarsus. Its tendon is inserted upon the inner side of the fourth toe. The *abductor*, which is larger than the adductor and dorsal, arises above from the inner edge of the fifth metatarsal bone, and from the whole outer surface of the fourth, and terminates on the outer side of the fourth toe. The relations of these muscles are the same as those of the interossei of the third toe.

1390. *Interosseus of the Fifth Toe.* It is an adductor, and belongs to the sole. It arises a little from the fibrous sheath of the peroneus longus, and from the two inferior thirds of the inner surface of the fifth metatarsal bone, and terminates on the inner surface of the fifth toe by a tendon which the fleshy fibres accompany as far as the articulation.

1391. The motions which the interossei of the foot impress upon the toes are similar to those which the interossei of the hand make the fingers perform (1249.)

OF THE ENVELOPING APONEUROSIS OF THE INFERIOR EXTREMITIES.

1392. The inferior extremities, like the superior (1250,) are enveloped in their whole extent, by a very distinct fibrous sheath, placed between the muscles and the integuments. This aponeurotic sheath changes its name according to the region in which it is examined. In the thigh it is called the *Crural Aponeurosis* or *Fascia lata*; in the leg, the *Tibial Aponeurosis*, or *Aponeurosis of the Leg*.

1393. *Crural Aponeurosis*. This is the strongest aponeurosis in the body. It is very thick at the outside of the thigh, but is less so anteriorly and posteriorly, and is still thinner at the inner side. It is formed of fibres crossing each other in different directions, and is perforated by a great number of holes for the passage of nerves and vessels. There is observed among others a very considerable one, situated before the pectineus muscle, under the crural arch, and which transmits the vena saphena. This hole is not a mere aperture, for its circumference is prolonged around the vein in the form of a very delicate fibrous sheath, which loses itself in the cellular tissue after proceeding to some distance.

This aponeurosis seems to arise, at its upper and fore part, from the abdominal aponeurosis (1101), and to contribute to the formation of the crural arch. It in fact commences by a very thin lamina which extends towards the flank, above that arch, to which it strongly adheres, as well as to the contour of the inguinal ring, sending off a transparent prolongation, which accompanies the cremaster muscle as far as the scrotum, where it loses itself in the cellular tissue of the dartos. Posteriorly, it has indistinct origins from the sacrum and coccyx, from whence it is expanded over the glutæus maximus and in the perineum, having the appearance of a very fine cellular web. Externally, it is attached to the outer lip of the iliac crest, then descends upon the glutæus medius, to which it affords points of attachment. It is here much more distinct. Internally, and still above, it is continuous with the ligament of the symphysis pubis, and with the periosteum of the sciatic tuberosity and the osseous branch which connects that eminence with the symphysis of the pubes. In the rest of its course, the crural aponeurosis is inserted into the whole length of the outer lip of the linea aspera of the femur, by a lamina firmly united to the triceps cruralis, and ascending between it and the short portion of the biceps. This lamina also receives, in a distinct manner, a very great number of fibres from the tendon of the glutæus maximus.

After being thus fixed, the aponeurosis in question envelopes the muscles of the thigh, and separates externally into two distinct laminæ, of which the outer and thinner covers the tensor muscle, while the other, which is thicker, sinks under it, and proceeds to the fibrous capsule of the thigh joint, and the curved tendon of the rectus femoris. Beneath the extensor muscle, these two laminæ unite, and constitute a kind of very thick and solid band, which descends vertically along the outer part of the thigh, being continuous at its edges with the rest of the aponeurosis.

Inferiorly, the aponeurosis is confounded around the knee with that of the leg. It also unites with the tendon of the triceps cruralis, and with its lateral prolongation, and is attached to the two tuberosities of the tibia, but especially to the outer.

1394. The *outer surface* of the crural aponeurosis is separated from the integuments by a thick layer of adipose cellular tissue, and by blood vessels, lymphatics and nerves. It sends around each of them a fibrous lamina, which envelopes them in a more or less irregular manner; and there are detached from it on all sides a considerable number of small filaments which lose themselves in the chorion of the skin. Toward the fold of the groin, it separates into several laminæ, which are interposed between the lymphatic ganglia of this region. Its *inner surface* covers the lower part of the obliquus externus abdominis, the cremaster muscle, a portion of the abdominal aponeurosis, of the iliacus muscle, and of the crural artery and vein, the sciatic nerve, the popliteal artery, and all the superficial muscles of the hip and thigh. It is separated from all these parts by adipose tissue. It only gives attachment to a few fibres of the glutæus medius.

1395. *Aponeurosis of the Leg.* This is less thick than the aponeurosis of the thigh. Its fibres also cross each other in different directions, but at the lower part of the leg, they are almost all transverse. It is very strong and dense anteriorly, and thin in the other directions. It is continuous above with the crural aponeurosis; but it also arises from the head of the fibula, and from several fibrous expansions which are detached from the tendons of the triceps extensor, sartorius, gracilis, and semitendinosus muscles. From thence it descends around the leg, attaching itself to the whole extent of the anterior and internal edges of the tibia, and sending downwards and backwards a pretty thick partition, which passes before the tendo Achillis, (1339), and behind the muscles of the deep and posterior layer of the leg, to ascend, between them and the soleus, to the middle of the leg, where it gradually loses itself.

1396. Below and before, this aponeurosis is continuous with the anterior annular ligament of the tarsus. Posteriorly, it gradually disappears towards the heel. Externally, it is inserted into the sheath of the tendon of the peronei; and internally, to the internal annular ligament. Its *outer surface* is covered by the integuments, by adipose tissue, blood vessels, lymphatics, and nerves. The *inner* is applied upon the superficial muscles of the leg, and gives attachment above to the tibialis anticus, extensor communis digitorum and peroneus longus. Inferiorly, it sends a prolongation between the two latter.

OF THE ANNULAR LIGAMENTS OF THE TARSUS.

1397. *Anterior Annular Ligament.* This is a quadrilateral fibrous bundle, extended transversely over the ankle, much thicker externally than at its inner part, and embracing the tendons of the extensors of the toes, and of the tibialis anticus and peroneus tertius. It is attached to the outer portion of the fore part of the superior depression of the calcaneum, whence it is immersed in the cellular tissue, and from whence it is directed inwards. It soon divides into two laminæ for the purpose of embracing the tendons of the extensor communis digitorum and peroneus tertius, beyond which these laminæ unite to separate again at the level of the tibialis anticus and extensor pollicis. Lastly, it terminates at the fore part of the malleolus internus, sending a very distinct prolongation to the os scaphoides and inner edge of the plantar aponeurosis. Its *anterior surface* is covered by the skin. The *posterior* is applied upon the tendons just mentioned, the anterior tibial nerve and vessels, and a small part of the extensor brevis digitorum pedis. Its *upper edge* is continuous with the aponeurosis of the leg. The *lower* sends over the back of the foot a thin and indistinct aponeurotic lamina, which gradually loses itself towards the toes in the cellular tissue, and which is commonly designated by the name of *dorsal aponeurosis of the foot.*

1398. *Internal Annular Ligament.* It is broader and less regularly defined than the other, and descends from the fore part of the malleolus internus to the posterior and inner part of the calcaneum, forming with that bone a sort of canal which contains the sheath of the tendons of the tibialis posticus, flexor longus digitorum, and flexor pollicis, as well as the plantar vessels and nerves, and a great quantity of adipose tissue. Above, it is continuous with the tibial aponeurosis; below, it gives attachment to the adductor pollicis, and is covered by the skin.

OF THE PLANTAR APONEUROSIS.

1399. The *Plantar Aponeurosis* is stronger and denser than the palmar (1255), to which it has a considerable resemblance in other respects. It is of a somewhat triangular form, and is divided into three portions, a middle, thicker, and broader, and two lateral, which are very thin, and applied upon the muscles of the great and small toes. It is attached, posteriorly, where it is very strong, to the posterior and inferior eminences of the calcaneum, directs itself forwards, becoming broader, and permitting its fibres to separate, sends two partitions between the superficial muscles of the sole of the foot, furnishes them with points of attachment, and, towards the fore part of the metatarsus, divides into five slips, subdividing each into two others, which ascend upon the sides of each articulation of the metatarsal bones and phalanges, with the ligaments of which they are intimately confounded, leaving, however, small apertures for the passage of the collateral vessels and nerves. The flexor tendons pass between their slips.

This aponeurosis is covered by the muscles of the sole of the foot. It furnishes insertions to the adductor pollicis, abductor minimi digiti and flexor brevis communis digitorum. Its *inferior surface* sends many fibres to the chorion of the skin, and rests upon a cellular tissue which appears to consist of small conglomerated masses.

Order in which the muscles ought to be dissected for the purpose of examining them all in the same subject.

Names of the Muscles.	Pages where they are described.
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Sterno-cleido-mastoideus	294
Digastricus	295
Stylo-hyoideus	296
Stylo-glossus	290
Mylo-hyoideus	296
Genio-hyoideus	297
Hyo-glossus	288
Genio-glossus	289
Lingualis	290
Sterno-hyoideus	298
Sterno-thyroideus	298
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Omo-hyoideus	297
Frontalis and occipitalis	269-270
The three muscles of the ear	270
Orbicularis palpebrarum	274
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Levator palpebræ superioris	276

Names of the Muscles.	Pages where they are described.
The six muscles of the eye	276
The eight muscles of the nasal and superior maxillary regions	279
Muscles of the inferior maxillary and intermaxillary regions	283
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Temporalis	287
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The muscles of the pharyngeal region	299
Those of the palatal region	291
Trapezius	301
Latissimus dorsi	267
Rhomboideus	302
Splenius	303
Complexus major	304
Complexus minor	305
Serratus posticus superior and inferior	266
The muscles of the posterior vertebral region	249
Pectoralis major	255
Pectoralis minor	257
Subclavius	258
Serratus magnus	258
Obliquus abdominis externus	314
Obliquus abdominis internus	315
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Intercostales externi	260
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Scalenus anticus	306
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Names of the Muscles.	Pages where they are described.
Muscles of the genital region	309
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Muscles of the anterior brachial region	324
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Supinator longus	341
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Muscles of the external palmar region	344
Muscles of the two anterior antibrachial regions	329
Muscles of the middle palmar region	347
Supinator brevis	342
Muscles of the glutæal region	353
Pyramidalis	318
Gemelli	358
Quadratus femoris	358
Muscles of the posterior crural region	362
Muscles of the anterior crural region	359
Muscles of the internal crural region	364
Tensor vaginæ femoris	367
Obturator externus	357
Obturator internus	357
Muscles of the anterior region of the leg	367
Muscles of the posterior and superficial region of the leg	371
Extensor brevis digitorum pedis	378
Muscles of the internal plantar region	380
Muscles of the external plantar region	382
Flexor brevis digitorum pedis	378
Muscles of the posterior and deep region of the leg	373
Musculus accessorius	379
Lumbricales	380
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FIRST CLASS.

ARTICLE SECOND.

ORGANS OF THE VOICE.

OF THE LARYNX AND ITS APPENDAGES.

GENERAL DISPOSITION.

1401. The *larynx*[*] is a rather complex apparatus, formed of several pieces moveable on each other, and which is itself capable of being moved with relation to the surrounding parts. Broader before than behind, and above than below, situated in the middle line of the body, at the upper and fore part of the neck, symmetrical and regular, it surmounts the trachea, with whose cavity it communicates. It is placed below the hyoid bone, opens at its level into the mouth, and is connected with it by ligaments. The pharynx separates it posteriorly from the vertebral column, and muscles are interposed between it and the skin anteriorly. Cartilages, ligaments, muscles, glands, membranes, vessels, and nerves enter into the composition of the larynx.

This apparatus is manifestly destined to afford a passage to the air for the act of respiration, and to impress upon it certain modifications which constitute the voice. Its dimensions vary in different individuals, and are not always proportional to the stature. It is observed, however, to be always larger and situated lower in the male than in the female.

OF THE DIFFERENT PARTS WHICH ENTER INTO THE COMPOSITION OF THE LARYNX.

1. *Of the Cartilages of the Larynx.*

OF THE THYROID CARTILAGE.[†]

1402. This is the largest of the cartilages of the larynx, and occupies its anterior and lateral parts. It is of greater extent in the transverse than in the perpendicular direction, and is broader above than below. It seems formed by the junction of two quadrilateral laminæ, which, uniting in the middle line of the neck, produce an angle, which is open behind, and more or less prominent before, but almost always perceptible beneath the integuments. Its *anterior surface* presents, in its middle, the longitudinal prominence just mentioned, and which is more marked above than below. On its sides are two somewhat concave surfaces, inclined outwards, obliquely traversed posteriorly by a slightly prominent ridge, which descends forwards, from the posterior edge to near the lateral third of the lower edge. This line gives attachment to the sterno-thyroideus and thyro-hyoideus muscles, which cover the greater part of the cartilage. Behind it is a small surface in contact with the constrictor pharyngis inferior, which is inserted upon it (1045), and sometimes a hole which gives passage to blood-vessels.

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[*] Λάρυγξ, Gr. *Caput Asperæ Arteriæ*, Lat.

[†] Θυρέος, *Scutum*, a shield.

The *posterior* surface of the thyroid cartilage presents in the middle a retiring angle, in which are inserted the ligaments of the glottis and the thyro-arytenoid muscles. On its sides, two plain surfaces, directed backwards and inwards, give attachment below to the crico-thyroid muscles, and correspond in part to the crico-arytenoidei laterales.

Its *upper edge*, which is longer than the others, and deeply notched in the middle, especially in the male, gives attachment in its whole extent, to the thyro-hyoid membrane. The *lower edge* is divided into three notches, of which the middle is larger, the two lateral a little contracted. The first is separated from the others by two more or less prominent tubercles, in which the two oblique lateral ridges terminate. This edge gives attachment, in its middle part, to the crico-thyroid membrane, and on its sides to the muscles of the same name.

The two *posterior edges*, which are rectilinear, rounded, and pretty thick, give attachment to some fibres of the stylo-pharyngei and palato-pharyngei muscles. They terminate above, each by a prolongation which is called the *Great Horn* of the thyroid cartilage. This appendage is more or less elongated, inclined backwards and inwards, narrower at the middle than at its extremity, and terminated by a small head which is connected with the extremity of the great horn of the hyoid bone by a round ligament. Above, they also present each a smaller eminence, which is pretty thick, rounded, and curved inwards. This is the *Small Horn* of the thyroid cartilage. Its summit, which is blunt, presents at its inner side a small smooth surface, somewhat concave, which is articulated with a similar surface of the cricoid cartilage.

OF THE CRICOID CARTILAGE.*

1403. This is thicker than the other cartilages of the larynx, and represents a kind of ring which occupies the lower part of that organ, and which is much higher behind than before. Its *external surface*, which is very narrow anteriorly, gives attachment there to the crico-thyroidei muscles. On the sides it becomes broader, is a little covered by the thyroid cartilage, and presents above a small rounded eminence, convex and polished at its summit, to be articulated with the small horns of that cartilage. Posteriorly, it becomes still broader, and presents a quadrilateral plane, at the middle of which a longitudinal prominence separates two depressions in which are inserted the posterior crico-arytenoid muscles. Its *inner surface* is lined by the mucous membrane of the larynx. Its *upper circumference* is obliquely cut in its two anterior thirds, where it gives attachment to the crico-thyroid membrane. Its posterior third, which is more elevated, is horizontal, and presents two smooth convex surfaces, inclined backwards and outwards, which are articulated with the base of the arytenoid cartilages. To the fore part of these surfaces are attached the lateral crico-arytenoid muscles. Its *inferior circumference* is horizontal, and placed at the same level in its whole extent. It is convex before, and a little notched at the sides, and is connected by a membrane with the first ring of the trachea.

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* Κρικος, *annulus*, a ring.

OF THE ARYTENOID CARTILAGES.*

1404. They are two in number, and are situated at the upper and back part of the larynx, above the cricoid cartilage, the level of which they surpass a little on the inner side. They are smaller than it, and have the form of a triangular pyramid, a little twisted upon itself from before backwards. Their *posterior surface*, which is concave, gives attachment to the arytenoideus muscle; the *anterior*, which is a little concave below, and convex above, corresponds to part of the arytenoid gland, and gives attachment to the thyro-arytenoidei muscles, and the ligaments of the glottis; the *inner*, which is narrow, flat and vertical, is invested by the mucous membrane of the larynx, and is in contact with that of the opposite side. These three surfaces are separated by as many prominent and sharp *edges*, of which the anterior presents several inequalities. The *base* of these cartilages presents posteriorly a concave and smooth articular surface, inclined downwards and inwards, and connected with that which the upper circumference of the cricoid cartilage presents. This surface is limited externally by a rounded tubercle, to which are attached the crico-arytenoideus lateralis and crico-arytenoideus posticus muscles. Anteriorly it presents a larger eminence, of a triangular form, sometimes isolated from the rest of the cartilage, and which gives attachment to the ligament of the glottis or the thyro-arytenoid ligaments. The *summit* of the ary-

* Ἀρυταινοειδής, in the form of a funnel.

tenoid cartilage is very thin and sharp. The mucous membrane envelopes it, and it is generally surmounted by a small cartilaginous body, the *Corniculum laryngis* of Soemmering, which is isolated and moveable, and is of a very irregular and variable form.

1405. The different cartilages of the larynx are precisely similar in their structure. They are solid and thick, of a greyish colour, and of a perfectly homogeneous tissue. They are invested by a kind of fibrous perichondrium. They have a very great tendency to become ossified, and when this is the case, they present small cellules in their interior like the bones of the skull. The arytenoid cartilages ossify more rarely than the others, and are only observed in that state in very advanced old age.

When ossification of the cartilages of the larynx takes place, it commences in the cricoid cartilage, by two germs, one on each side; in the thyroid cartilage, by each its posterior edges, and frequently also by its superior processes; in the arytenoid cartilages by the base.

OF THE EPIGLOTTIS.*

1406. The *Epiglottis* is a fibro-cartilage, situated at the upper part of the larynx, behind the base of the tongue. Its form is oval, its colour a pale yellow, its tissue very elastic, its thickness greater below than above, at the middle than below. Its large extremity is free. It is broad, and curved a little upwards on the side next the tongue. The small extremity is contracted and directed downwards, and is connected with the notch in the upper edge of the thyroid cartilage by a dense bundle of ligamentous fibres, embraced anteriorly by the gland of the epiglottis. Sometimes it is divided into three distinct portions. The *lingual surface* of the epiglottis, which is inclined upwards, concave from above downwards, and convex transversely, is covered above by the mucous membrane of the mouth. Inferiorly, it is connected with the hyoid bone and the base of the tongue. A longitudinal and rather indistinct line seems to divide it into two equal parts. Its *laryngeal surface*, which is directed downwards, is concave and convex in the opposite direction of the preceding, and is covered by the membrane of the larynx. These two surfaces, the latter especially, are covered with a great number of depressions like pin holes, which contain mucous follicles. Some of these depressions are true holes, which vary in size, but have very regular and rounded margins, and pass through the epiglottis directly, and never obliquely. They are observed towards the lower part. Several of these apertures also transmit nervous filaments.

The direction of the epiglottis is liable to vary in the different circumstances of life. It is vertical in the most common state, but becomes horizontal when the food passes from the mouth into the œsophagus.

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* Ἐπι, upon; Γλωττις, the glottis.

The epiglottis is rarely ossified. When this happens, it presents a multitude of small bony nuclei, irregularly disseminated, and separated by very visible areolæ.

II. *Of the Ligaments of the Larynx.*

OF THE THYRO-HYOID ARTICULATION.

1407. The thyroid cartilage is connected at its upper edge with the hyoid bone by means of a very broad yellowish membrane, thicker in its middle part than at the sides, rather cellular than fibrous, covered on its *anterior surface* by the thyro-hyoidei, sterno-hyoidei, and omo-hyoidei muscles, and lined on the *posterior surface* by the mucous membrane of the larynx, and the base of the epiglottis, from which it is separated by the gland of that name. The *upper edge* of this membrane, which is called the *Thyro-hyoid Membrane*, is attached to the posterior surface of the body and great horns of the hyoid bone; and the *lower edge*, to the whole length of the upper edge of the thyroid cartilage.

The *great horns* of this cartilage are connected with the extremity of those of the hyoid bone by two round fibrous cords, about an inch long, and almost always containing two or three cartilaginous grains.

OF THE CRICO-THYROID ARTICULATIONS.

1408. In the middle and anteriorly, the thyroid cartilage is connected with the cricoid by the *Crico-thyroid Membrane.* This membrane is distinctly fibrous, of a yellowish colour, thick, especially at the middle, perforated with several small apertures, which give passage to blood-vessels. It is attached to the two anterior thirds of the upper circumference of the cricoid cartilage, and is fixed, on the other hand, to the middle part of the lower edge of the thyroid cartilage, on the sides of which it is gradually confounded with the mucous membrane of the larynx, which it strengthens. Its *anterior surface* is covered by the sterno-hyoidei and crico-thyroidei muscles, and is traversed in a transverse direction by a small artery. The *posterior surface* is invested by the mucous membrane of the larynx.

On the sides, the small horns of the thyroid cartilage are articulated by arthrodia with the cricoid cartilage, by means of small smooth surfaces, which are covered by a loose and pretty humid synovial membrane. Two ligaments, an *anterior*, which descends forwards from the small horn over the cricoid cartilage, and a *posterior*, which ascends backwards from the same point, towards the base of the arytenoid cartilages, where it is expanded, keep these parts in connexion. They are also kept down by several irregular fibres, which are less distinct.

OF THE CRICO-ARYTENOID ARTICULATION.

1409. Each arytenoid cartilage is also articulated by arthrodia with the cricoid cartilage, by means of surfaces, which we have already described, and which are invested by a synovial capsule, and strengthened by some ligamentous fibres. These fibres are larger internally and posteriorly, and there constitute a triangular bundle.

OF THE THYRO-ARYTENOID ARTICULATION.

1410. On the inside of the larynx, there are observed two ligaments, about two lines in breadth, thicker internally than externally, formed of elastic and parallel fibres, contained in a fold of the mucous membrane. They are extended horizontally, proceeding forwards, and a little inwards, from the anterior prominence of the base of each arytenoid cartilage, to the middle of the retiring angle of the thyroid cartilage, where they are interlaced with each other. They form the principal part of what is named the *Vocal Cords*. they are connected externally with the thyro-arytenoideus muscle, which they separate from the crico-arytenoideus lateralis. They are covered in the rest of their extent by the mucous membrane.

1411. Sometimes a fibrous bundle, passing transversely before the arytenoid muscle, extends from one of the arytenoid cartilages to the other. We have already pointed out the manner in which the epiglottis and the thyroid cartilage are connected.

III. *Of the Muscles of the Larynx.*

OF THE CRICO-THYROIDEI.

1412. These muscles are two in number, and are situated on the sides and at the fore part of the lower portion of the larynx. Each of them is thin, quadrilateral, broader above than below, often divided into two portions by an adipose line. It arises from the side and fore part of the cricoid cartilage, ascends obliquely backwards and outwards, and terminates at the lateral part of the lower edge of the thyroid cartilage, and at the anterior edge of its small horn, leaving above, between it and its fellow, an interval in which the crico-thyroid membrane is seen. Their *anterior surface* is covered by the sterno-thyroideus and constrictor pharyngis inferior muscles, and by the thyroid body. The *posterior* corresponds to the crico-thyroid membrane, and the crico-arytenoideus lateralis muscle.

OF THE CRICO-ARYTENOIDEI POSTICI.

1413. These are also two in number, and are situated at the back part of the larynx. Each of them is thin, flat and triangular, and arises from the longitudinal depression which is observed on either side of the posterior prominent line of the cricoid cartilage. Their fibres, which are shorter and nearly transverse above, and so much the longer, and directed more obliquely outwards the lower they are examined, terminate behind the base of the arytenoid cartilage, between the crico-arytenoideus lateralis and arytenoideus muscles. Their *posterior surface* is lined by the mucous membrane of the pharynx. The *anterior* lies upon the cricoid cartilage.

OF THE CRICO-ARYTENOIDEI LATERALES.

1414. Each of these muscles occupies the side of the larynx. It is thin, flat, and of a trapezoidal figure. Arising from the side of the upper circumference of the cricoid cartilage, it proceeds obliquely upwards and backwards, to be attached by short aponeuroses, to the outer and forepart of the base of the arytenoid cartilage, where it is confounded with the crico-arytenoideus. Its *outer surface* is separated from the thyroid cartilage by cellular tissue. The *inner* is lined by the membrane of the larynx.

OF THE THYRO-ARYTENOIDEI.

1415. These muscles are very thin, transversely flattened, broader before than behind, and of an irregular form. They arise from the middle and lower part of the posterior surface of the thyroid cartilage, whence they proceed backwards and outwards, to be attached to the outer part of the base of the arytenoid cartilage, immediately above the preceding muscles. Their *outer surface* is covered by the thyroid cartilage and the membrane of the pharynx. Their *inner surface* is lined by the membrane of the larynx.

OF THE ARYTENOIDEUS.

1416. This is a single muscle, situated at the posterior and upper part of the larynx, behind the two arytenoid cartilages. It is formed of several planes of fibres having different directions, which has caused it to be divided by many anatomists into several distinct muscles. Of these fibres, some ascend obliquely from the base of the right arytenoid cartilage towards the summit of the left; others follow the reverse direction; and some, which are more superficial, proceed transversely from the middle part of one of the cartilages to the same part on that of the opposite side. Certain oblique fibres may sometimes be followed in the substance of the mucous membrane, as far as the sides of the epiglottis. They have been designated by some authors under the name of *Aryteno-epiglottidei*. Its *posterior surface* is invested by the membrane of the pharynx, while the *anterior* is applied upon that of the larynx, and upon the artytenoid cartilages.

IV. *Of the Mucous Membrane and Glands of the Larynx.*

OF THE COURSE OF THE MUCOUS MEMBRANE OF THE LARYNX.

1417. This membrane is continuous at its upper part in an obvious manner with that which invests the interior of the mouth, and below with that which lines the trachea and bronchi. Commencing at the base of the tongue, it proceeds at first over the anterior surface of the epiglottis, where it forms three folds, which have erroneously been considered as ligaments. Of these folds, the middle one, which is more distinct than the others, ascends towards the summit of the fibro-cartilage, and is stretched when the epiglottis is depressed, while those which are upon the sides lose themselves on the edge of the epiglottis, and appear loose in all cases. Arrived at the circumference of this fibro-cartilage, the membrane of the larynx is reflected from above downwards over its posterior surface, lines it without forming folds, and penetrates into the larynx; but on the sides it leaves the circumference, and is applied upon itself so as to form, on either side, a fold which proceeds directly to each of the arytenoid cartilages, covering a part of the thyro-arytenoidei muscles. It is then continued backwards and outwards into the membrane of the pharynx, and penetrates inwards into the larynx. Towards the base of the arytenoid cartilages, it forms, on either side, another fold, which proceeds horizontally forwards toward the retiring angle of the thyroid cartilage. Farther down, it lines a depression which is named the ventricle of the larynx; and still lower, it embraces the thyro-arytenoid ligament, under which it covers the internal surface of the cricoid cartilage and crico-thyroid membrane.

OF THE ORGANIZATION OF THE MUCOUS MEMBRANE OF THE LARYNX.

1418. This membrane is of a rose colour, very different from the deep red tint which the mucous membrane of the mouth presents. Although it is soft, spongy, continually moistened, and highly vascular, its tissue is yet in general very firm. This becomes especially evident in the places where it is in contact with the cartilages. There, in fact, it is intimately united with their perichondrium. It contains in its substance a number of mucous follicles, whose narrow orifices are pretty easily perceived, especially on the inferior surface of the epiglottis, and in the ventricles of the larynx; but papillæ are rarely observed, as in most of the other mucous membranes. The fluid which it separates is less viscid and tenacious than that of the pituitary membrane; but it has more consistence than that which is furnished by the buccal membrane.

OF THE PERIGLOTTIS OF GLAND OF THE EPIGLOTTIS.

1419. This is a mass of small glandular grains, sometimes agglomerated, sometimes isolated, deeply immersed in a great quantity of very dense adipose cellular tissue, and occupying, at the lower part of the anterior surface of the epiglottis, a triangular space, limited anteriorly by the thyroid cartilage and thyro-hyoid membrane. In some subjects, this gland cannot be distinguished amid the adipose body which contains it; but in general, the follicles of which it is composed, are seen forming small series which are prolonged as far as the edge of the epiglottis, and into the mucous folds which surround it, and occupying all the apertures which that fibro-cartilage presents towards its inferior extremity, to pour the product of their secretion over its laryngeal surface.

OF THE ARYTENOID GLANDS.

1420. These glands are commonly compared to the letter L, and are lodged in the folds which the mucous membrane presents in passing from the epiglottis to the arytenoid cartilages, and from these to the thyroid cartilage. They are formed by an agglomeration of small grains pretty much resembling the tissue of the lachrymal gland, their colour varies from gray to reddish white, and their tissue is compact and firm. Their vertical branch, which is rounded and considerably distant from the corresponding arytenoid cartilage, is free in the aryteno-epiglottic fold. The horizontal branch runs above the fold which limits the ventricle of the larynx above, and is a little less prominent than the other. The angle which these two branches form by their union is connected with the base of the arytenoid cartilage.

The excretory orifices of the arytenoid glands are only seen with much difficulty.

Of the Larynx considered in General.

1421. This organ, considered in its collective capacity, has in some measure the form of a reversed cone, of which the base is directed upwards towards the tongue, and the summit downwards towards the trachea. Two surfaces and two extremities are distingished in it.

1422. *External surface of the Larynx.*—It presents *anteriorly* the middle prominence of the thyroid cartilage, which is larger in the male than in the female; the two oblique surfaces placed on its sides; the ridge which traverses them behind; a triangular surface which is covered by the constrictor pharyngis inferior; the small horns of the thyroid cartilage and their articulation with the cricoid; the crico-thyroid membrane; the two muscles of the same name, and a part of the cricoid cartilage. *Posteriorly*, there are observed on the outside of the larynx the arytenoid muscle; the middle and posterior line of the cricoid cartilage, the posterior crico-arytenoid muscles; a vacant space placed on each side between the cricoid and thyroid cartilages, broad above, narrow below, of greater extent in man than in woman, filled by adipose cellular tissue, and limited externally by the posterior edge of the thyroid cartilage, which is more prominent than the other parts of the larynx.

1423. *Internal Surface of the Larynx.*—It is lined in its whole extent by the mucous membrane. At its lower part, it is formed by the cricoid cartilage, and presents nothing remarkable. Towards the middle, on either side, it presents the *Vocal Cords*, or the *Inferior Ligaments of the Glottis*, which are formed by the thyro-arytenoid ligaments invested by the mucous membrane (1410). Above the vocal cords, are two elongated depressions, of a variable depth, extended from the thyroid to the arytenoid cartilages. Their aperture, which is always open and of an elliptical form, is larger than their bottom, and directed inwards and a little upwards. Their bottom is covered by the thyro-arytenoideus muscle. They are named the *Ventricles* or *Sinuses of the larynx.* In man they are more deeply situated and more distant from the external aperture than in woman, because in him the arytenoid cartilages are longer and more elevated. They are themselves surmounted by a fold of the mucous membrane (1410); which anatomists have named the *Superior Ligament* of the *Glottis*, and which is parallel to the vocal cords.

The interval comprised between the superior ligament and the inferior ligament of one side and those of the other, and by which the air enters into the respiratory passages, or issues from them, is the *Glottis.** This aperture, which is of an oblong form, its greatest diameter being from behind forwards, is about ten or eleven lines long in an adult man. Posteriorly, where it is formed by the separation existing between the anterior prominences of the base of the two arytenoid cartilages, it is from two to three lines in breadth; but anteriorly, it is much narrower, in consequence of the approximation of the two ligaments by which it is formed. In the female, the dimensions of the glottis are a little less. They also vary in different individuals, and even in the different circumstances of life, from the motions which the arytenoid cartilages perform.

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* Γλωττις, of the Greeks.

1424. The *Inferior Extremity* of the larynx, which is of greater extent in man than in woman, represents a circle pretty accurately traced and formed by the lower circumference of the cricoid cartilage. It is connected by a fibrous membrane with the first ring of the trachea. Its *upper extremity* is much wider than the lower. It is formed anteriorly and on the sides by the upper edge of the thyroid cartilage, behind the middle of which there is perceived the triangular space occupied by the gland of the epiglottis, and closed by a sort of fibrous membrane, thicker at the middle than at the edges, attached to the posterior cavity of the body of the hyoid bone, (317) and to the middle part of the epiglottis, beneath the place where the mucous membrane is reflected. Farther back, we find the epiglottis itself and its different glosso-epiglottic and aryteno-epiglottic mucous folds; together with the superior aperture of the larynx, placed above the glottis, and formed laterally by these latter folds, anteriorly by the epiglottis, posteriorly by the arytenoid cartilages. In its ordinary state it presents the figure of a triangle of which the base is before and the summit behind. It is directed a little obliquely backwards and downwards. This aperture must not be confounded with the glottis, which is situated beneath it, (1425). The arteries of the larynx are furnished by the superior and inferior thyroid branches. Its veins discharge themselves into the corresponding trunks. Its lymphatics lose themselves in the inferior jugular ganglia.* Its nerves are derived especially from the pair of pneumo-gastric nerves, and from the two superior cervical ganglia.

Of the Thyroid Body or Gland.

1426. The *Thyroid Body or Gland, (Glandula thyroidea,)* is an organ respecting the uses of which we are totally ignorant, and which anatomists usually describe after the larynx, on account of its situation. It in fact covers the lower and anterior parts of that organ, as well as the first rings of the trachea. This body exhibits great differences in its form in different individuals, and at different ages in the same individual, without our being able to assign any reasons for them; but, in general, it is larger in the child than in the adult, and in the female than in the male. It is more constant in its form. It seems composed of two oval lobes, flattened from before backwards, thicker below than above, and having a more or less oblique direction in different individuals. These two lobes are sometimes united in a great part of their extent; but in general they are separated, and are only connected with each other by a sort of transverse cord, more or less broad and thick, and which is named the *Isthmus of the Thyroid Gland.* This cord is sometimes wanting, and has never the same appearance in two subjects, nor does it ever ascend as high as the larynx, which is embraced in the concavity of the crescent, which it forms in conjunction with the two lateral lobes.

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* When speaking of the Sympathetic System the Student is to understand by the word *ganglion* what is commonly called a conglobate gland.

1427. The *anterior surface* of the thyroid body, which is genenerally convex over its whole extent, is covered in the middle by the sterno-thyroidei and sterno-hyoidei muscles, and on the sides by the latissimi colli, omo-hyoidei, and sterno-cleido-mastoidei. Its *posterior surface*, which is concave, is connected by a filamentous cellular tissue with the larynx and the first rings of the trachea. It also covers the crico-thyroidei, thyro-hyoidei and constrictores pharyngis inferiores. Its *posterior* and *lateral edges* rest upon the trunks of the carotid arteries, the internal jugular veins, the pneumo-gastric and recurrent nerves, the communicating cords of the cervical ganglia, and that of the left side only, on the œsophagus. Its *upper edge*, which is deeply notched in the middle, is coasted by the superior thyroid arteries. The *lower edge*, which is convex, is in like manner coasted by arteries, and gives rise to large veins. The *upper extremities* of its lateral lobes are lodged between the thyroid cartilage and the trunks of the carotid arteries; the *lower*, between these arteries and the trachea.

1428. The thyroid body is not contained in any membrane. The cellular tissue by which it is immediately surrounded seems alone to supply it with an envelope, which is somewhat dense and never contains fat.*

1429. The proper tissue of the thyroid body is soft and spongy. Its colour varies much. Most commonly it is of a brownish red, deeper in women and children than in men and adults; sometimes it has a gray or yellowish tint. Its intimate texture is not yet well known. The greater number of anatomists liken it to that of the glands; and this body is in fact composed of several distinct lobules, agglomerated into lobes of greater or less size. Their intervals are occupied by a delicate cellular tissue, which never presents any adipose matter; but it is in small quantity. An oily fluid of a yellowish colour, seems to fill the areolæ without being contained in particular cavities. Very frequently, however, there are observed disseminated here and there in the substance of the organ, vesicles swelled with a milky or colourless fluid, thick or thin, transparent or opaque. They vary much in size and number, and sometimes are entirely wanting.

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* Many anatomists have described a small muscular slip, found most generally on one side only as a *levator glandulæ thyroideæ*; the muscular fibres composing this slip proceed from below upwards, or from one of the lobes of the thyroid body towards the thyroid cartilage and hyoid bone.

1430. The thyroid body receives four principal arteries furnished by the external carotid and subclavian arteries, and frequently the arch of the aorta sends a separate branch to it. Its veins are very numerous, and accompany the arteries, or issue from its lower edge. Its nerves come from the pneumo-gastric nerves and cervical ganglia. Its lymphatics lose themselves in the jugular ganglia. No appearance of an excretory duct has ever been discovered in it.

ARTICLE THIRD.

ORGANS OF SENSATION.

1. *Of the Encephalon (Brain and Spinal Marrow,) or Common Centre of Perceptions and Volitions.*

1431. The *Encephalon** is a soft pulpy organ, which is contained in the cavity of the skull, and in the vertebral canal (72,) and which is the centre of most of the nerves, of the sensations and acts of volition. Symmetrical and regular, like the cavities which contain it, proportionally larger in the child than in the adult, in man than in woman.† "This organ is divided, according to its length and in the direction of the median line of the trunk, into two equal portions, the one right and the other left. But these portions, which in part of their extent are distinct, and separated by a more or less deep slit or groove, are in several places brought together, and intimately united by laminæ, forming reciprocal commissures."‡ It consists also of single parts placed along the median line, and of double parts which occupy the sides of that line. But, besides this longitudinal division, there are also observed fissures which divide the brain in the direction of its breadth, and which permit it to be considered, for the facility of study only, as formed of four parts, very different from each other in respect to size, situation, texture, and form. The first of these parts is the *Brain* proper, or *Cerebrum*, which occupies the greater part of the cavity of the skull; the second is the *Cerebellum*, which is much smaller, and is lodged in the inferior occipital fossæ; the third, which is situated at the base of the skull, is the *Cerebral Protuberance* or *Mesocephalon;* and the fourth is the *Medulla Spinalis* or *Spinal Marrow*.

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* 'Ενκεφαλος, ἐν τῃ κεφαλῃ, placed within the head.

† At the moment of birth, the weight of the brain forms the sixth or seventh part of that of the whole body. In the full-grown man it is not more than about the thirty-fifth part.

‡ Chaussier, Expos. Soemm. de la Structure de l'Enceph, 1807.

1432. The brain is enveloped by three membranes, of which the outer is named the *Dura Mater;* the middle, the *Tunica Arachnoidea;* and the inner, the *Pia Mater*.

1. OF THE BRAIN PROPER, OR CEREBRUM, CONSIDERED WITH REFERENCE TO ITS EXTERIOR.

1433. The *Cerebrum* is the largest portion of the encephalon. It occupies the whole upper part of the cavity of the skull, extending from the forehead to the superior occipital fossæ, and resting anteriorly upon the orbitar arches, in the middle upon the middle fossæ of the base of the skull, and behind upon a fold of the dura mater, named the *Tentorium Cerebelli*. Its form is that of an ovoid pretty uniformly convex above, slightly compressed on the sides, and flattened beneath. Its large extremity is directed backwards, which corresponds to the figure of the skull, (221.)

1434. There are distinguished in the brain a *superior region*, convex and rounded, which corresponds to the bones of the vault of the cranium, and an *inferior region*, unequally rounded on the edges, flattened in the middle, and moulded upon the base of that cavity.

1435. *Upper surface of the Brain.* It presents, in the median line, a *deep fissure* occupied by the fold of the dura mater, designated by the name of *Falx Cerebri*. Anteriorly and posteriorly, this fissure, of which the upper edge has the form of a half ellipse, divides the brain in its whole height; but in the middle, it is limited by a white lamina which is named the *Corpus Callosum* or *Middle Lobe*. There results from this that the organ seems to be separated by it into two parts, a right and a left. These are the *Hemispheres* or *Lobes* of the Brain, which have each the form of the fourth of an ovoid, are elongated from behind forwards, and present an *inner surface*, plain and vertical, corresponding to that of the opposite lobe, seeming continuous below and in the middle with the corpus callosum, on the upper part of which it forms a longitudinal slit, analogous to the ventricles of the larynx, and in which are lodged branches of arteries; and an *upper* and *outer surface* which is convex and rounded.

The whole surface of the cerebral lobes or hemispheres is remarkable for a great number of eminences, rounded on their edges, flexuous, undulated, penetrating each other by reciprocal inequalities, and having some resemblance to the disposition of the small intestine in the abdomen. These eminences are named the *Circumvolutions* of the Brain *(Gyri,)* while the depressions by which they are separated are called *Anfractuosities* or *Furrows*, (*Anfractus seu Sulci.*)

The number and size of the circumvolutions of the brain vary exceedingly. They are seldom found the same in the two lobes. In individuals of the same age, they are sometimes very large, and sometimes very small. In general, they are of small size in fetuses and newly-born children. The anfractuosities are equally variable in their disposition. Always narrow, of a depth always about equal and extending to an inch, they are sometimes very long, and sometimes very short. They are lined by prolongations of the pia mater. Their direction is transverse, longitudinal or oblique. Some of them are simple, but the greater number present subdivisions in their course, and are continuous with the neighbouring ones, while there are some which proceed towards the inferior surface of the brain. In these anfractuosities, there are observed deep-seated secondary prominences, which, arising from one circumvolution, are inserted into corresponding depressions formed upon the contiguous circumvolution. The circumvolutions and anfractuosities of the brain do not, as Bichat remarks, at all correspond to the eminences and cavities of the inner surface of the skull.

1436. *Lower Surface of the Brain.* This surface of the brain has been regarded by most anatomists as formed of several distinct regions, which they have named *Lobes*, and which occupy the base of the hemispheres. These lobes are three in number on each side. The *anterior* rests upon the orbitar arch; the second or *middle* forms a considerable prominence below the level of the first, and fills the middle and lateral fossæ of the base of the skull; the third, or *posterior*, is supported by the tentorium cerebelli, and presents a slight excavation. The base of the cerebrum presents first, at its fore part and in the median line, a fissure, which is the termination of the great fissure that separates the hemispheres. This fissure is only filled by the cerebral falx in its anterior third, its two posterior thirds being occupied by vascular prolongations which pass from one hemisphere to the other. It is limited above by the anterior part of the corpus callosum. It separates from each other the two anterior lobes, whose plain, nearly triangular, and anteriorly contracted surface is observed on its sides. On each of these lobes is formed a very deep rectilinear groove, which seems to be an anfractuosity separating two circumvolutions. It is directed from behind forwards, and a little from without inwards, and lodges the trunk of the olfactory nerve.

On the outside of this groove, are some anfractuosities and circumvolutions less distinct than those of the upper region, and at its back part there is observed, on each side, between the anterior and middle lobes, a considerable angular transverse depression, which lodges one of the principal branches of the internal carotid artery, and which is prolonged obliquely upwards and backwards upon the convex surface of the hemisphere, where it is lost in the neighbouring anfractuosities. This is the *Fissura Sylvii*, which corresponds to the posterior edge of the process of Ingrassias (116,) and is continued inwards and backwards, nearly at a right angle, into another longitudinal fissure, limited externally by the middle lobe, internally by the optic nerves and the anterior peduncles of the cerebral protuberance. This second fissure allows the pia matter to pass into the lateral ventricles of the brain; but it is closed by the arachnoid membrane. Posteriorly, it communicates with a transverse fissure of which we shall presently speak. Towards the point of union of these two fissures, there is seen a whitish space, perforated with several apertures which admit vessels of considerable size, thus presenting an arrangement of rare occurrence at the surface of the brain. This white surface also presents some striæ, and ascends towards the corpus callosum, with which it seems to be continuous

Between the two interlobular fissures, is the commissure of the optic nerves, from the upper surface of which there is seen to rise a grayish membrane, of a pulpy consistence and yet pretty firm, transparent and furnished with but few vessels, which closes the anterior extremity of the third ventricle, and proceeds to the anterior and inferior part of the corpus callosum.

Behind the commissure of the optic nerves is a grayish tubercle, the *Tuber cinereum* of Soemmering, which is connected with these nerves, under which it sinks a little, and is prolonged posteriorly as far as the mamillary eminences, which are as it were enveloped by it. It forms a part of the floor of the third ventricle, and contains in its centre a small nucleus of white substance.

From the middle of this tubercle, descends obliquely forwards the *Pituitary Stem*, a sort of thin, slender, conical prolongation, of a reddish colour, which passes under the commissure of the optic nerves, and terminates by its summit, in a small soft body, lodged in the pituitary fossa of the sphenoid bone (115.) It is not hollow internally, as several authors have supposed, and it is invested by an envelope furnished by the arachnoid membrane.

The small organ in which this stem ends bears the name of *Pituitary Gland*. Its structure and uses are not yet well known. It is rounded and transversely elongated, and rests upon the dura mater, which surrounds it on all sides, excepting at its upper part, on which the arachnoid membrane is expanded. It does not present the uniform vascular structure peculiar to glands; but it is evidently composed of two portions, intimately connected, yet distinct. The first of these portions, which is the largest, is anterior. It is of a grayish yellow colour, convex before, notched behind, and of the form of a kidney. The posterior, which is smaller, is soft, pulpy, and impregnated with a whitish viscid fluid. The pituitary gland is traversed by some blood-vessels. It sometimes contains small calculous concretions.

The *Mammillary* or *Pisiform Tubercles*, (*Corpora Albicantia*,) are situated behind the gray substance from which the pituitary stem takes its rise. They have the form and size of a pea, are white externally, of a gray colour within, and are united to each other by a small grayish band which is easily torn, and which contributes to form the floor of the third ventricle. It is in them that the anterior prolongations of the fornix end.

Farther back, between the anterior peduncles of the cerebral protuberance, there occurs a triangular excavation, of which the bottom, filled by the white substance, also forms part of the floor of the third ventricle, and is perforated by several apertures for vessels.

On the sides of these anterior peduncles, are seen the middle lobes of the brain, separated from the posterior by a groove directed obliquely backwards, much less deep than the fissura Sylvii, and corresponding to the upper edge of the petrous process of the temporal bone. Both present anfractuosities and circumvolutions, which are less sinuous than those of the upper surface of the hemispheres. The depth of the former does not equal half of that of the upper anfractuosities.

Between the posterior and middle lobes of one side and those of the other, is placed the cerebral protuberance, behind which occurs the posterior extremity of the corpus callosum, uniting the two cerebral hemispheres. Between this extremity and the upper surface of the protuberance, is a broad transverse slit, which conducts into the third ventricle the arachnoid membrane and pia mater, and which contains the arachnoid canal and the pineal gland. To the right and left, it is continuous with another semicircular slit, placed between the corpora fimbriata and the thalami of the optic nerves, at the bottom of a fissure which we have described, and which allows the pia mater to penetrate into the lateral ventricles. These three slits, thus united, establish a manifest communication between the exterior of the brain and its internal cavities, and Bichat gives them the general name of the *Great Cerebral Slit* or *fissure.*

Lastly, there is observed, at the backmost part, and in the median line of the inferior surface of the brain, the termination of the great interlobular fissure, which lodges the end of the falx cerebri.

2. OF THE CEREBELLUM CONSIDERED WITH REFERENCE TO ITS EXTERIOR.

1437. The *Cerebellum* is less than a third of the size of the brain. Its weight, which varies much according to the different ages, is commonly in the adult man, the eight or ninth part of that of the brain, and the sixteenth or eighteenth in the new-born infant. Its form, which is symmetrical and regular, corresponds to that of the inferior occipital fossæ, in which it is lodged. Its breadth is much greater than its height, and it may be compared to two depressed spheroids, placed beside each other on a horizontal plane, and confounded by a portion of their surface. It is of a reddish gray colour externally, and is soft and proportionally lighter than the brain. Its surface presents an assemblage of gray laminæ, *(Folia Cerebelli,)* from a line to a line and a half thick, placed against each other, concentric, regular, more extended posteriorly, shorter before, separated by narrow grooves, which are lined by the pia mater, and over which the arachnoid membrane passes. Of these laminæ, some are confined to the upper surface of the cerebellum, the others to the lower surface. They are not confounded with each other, and none of them extends round the organ. Each lobe of the cerebellum commonly presents from sixty to sixty-five of these laminæ, from thirty to thirty-five on its upper surface, and from twenty-four to thirty on the lower. But on separating these principal laminæ, there are perceived many other similar in form, but smaller and thinner, entirely concealed in the grooves and covering each other in part. Some of them are very short, and are scarcely a line or two in height; others are larger; but none of them reaches the surface of the cerebellum, and they are all attached by their base to one of the principal circumvolutions, of which they are in a manner so many ramifications. Chaussier, who first made known the greater part of these peculiarities, says, that the number of these secondary laminæ, which is always very great, is subject to many individual variations. They would appear generally to amount to six or seven hundred.

The principal laminæ themselves, although they are all separated by a groove, unite together to the number of two, three, four, five or six, in such a manner as to divide the surface of the cerebellum into *fasciculate lobules.* These lobules are distinguished from each other by broader and deeper grooves, as well as by the disposition and direction of the laminæ, which are not parallel, but almost all intersect each other at a more or less acute angle. Their number is considerable, there being commonly sixteen, five *superior*, two *posterior*, and nine *inferior.*

1438. *Upper Surface of the Cerebellum.* Flat, inclined obliquely backwards and outwards, and covered by the tentorium cerebelli, it presents on its fore and middle part, an elongated prominence, named the *Processus Vermiformis superior*, which is formed by the reciprocal crossing of the laminæ of which the two lobes or hemispheres of the organ are composed. The whole of this upper surface is occupied by five fasciculate lobules, common to the two lobes, and disposed in transverse arched bands. Their convexity is directed backwards. They are only flexuous in the median line, and they are nearly of the same form. The first or most anterior, which is of less extent than the other, is less curved than they. Its laminæ extend without interruption from one lobe to the other, and are only a little broader in the median line, where they form a pretty considerable prominence. The other four lobules are successively longer and less arched. Their laminæ seem interrupted along the median line. Some of them separate from one to unite with another, or are bent in such a manner as to form a sort of nucleus. Others terminate at the bottom of a groove by an angular slip. Some laminæ of the right lobe end on the left, and the reverse. Other lamellæ form in this place, and mingle with the rest during their passage. It is from this disposition that the processus vermiformis of which we have spoken results.

1439. *Inferior Surface of the Cerebellum.* It presents a deep depression in the median line, named the *Valley*, which lodges anteriorly the commencement of the spinal marrow, and is divided posteriorly into two by a pretty large eminence, called the *Processus vermiformis inferior.* It is surrounded on both sides by a band of white substance. It is a true lamellated lobule, composed of a great number of parallel transverse laminæ, unequal in size and height. Some of them are prolongations of the slips which terminate the lateral lobules; others arise in the intervals of the grooves, and are more or less long. At the middle, where this lobule is broader and higher, its laminæ are triangular. Posteriorly, it presents a rather flat tubercle. Anteriorly, it is terminated by a narrow, rounded prolongation, from seven to eight lines in length, and four or five in breadth, which has by some been improperly compared to the uvula, and is generally named the *Mamillary Eminence* of the inferior vermiform process.

On each side, the inferior part of the cerebellum presents a very convex rounded surface, raised in the middle, on which there are distinguished four lobules which describe concentric arches, and are turned inwards to end at the middle depression. The first of them is less long, but broader and thicker than the others. It is composed of a great number of concentric laminæ differing in their extent and direction. Those which occupy the edges of the median fossa are short, and form a sort of rounded protuberance. At the outer side of this first lobule, and a little before it, is a small foliated or lamellated tuft, of an oblong form, rounded, rather low, and distinguished by the small size of its laminæ and by a very distinct groove. It is the *Lobule of the par vagum* of Vicq d'Azyr, the *Appendice Lobulaire* of Chaussier.

The other lateral inferior lobules are less compounded than the first, and become successively longer. Their laminæ are less oblique. They do not preserve the same thickness in their whole extent. Their laminæ are seen to blend with each other in different places. The last terminates by a rounded slip in the median depression.

1440. *Circumference of the Cerebellum.* Anteriorly and posteriorly, the curvature of this circumference, is interrupted by two notches or broad depressions, of which the *posterior* corresponds to the internal occipital crest, and receives the falx cerebelli; while the *anterior*, which is broader and of a semilunar form, embraces a part of the cerebral protuberance, and the commencement of the spinal marrow. This circumference is moreover traversed by a large *horizontal groove*, pretty deep in its whole extent, and very wide before. Altogether posteriorly, on each side of the posterior notch, the circumference of the cerebellum presents a distinct lobule, resembling a cuneiform segment of an ovoid, and composed of a great quantity of laminæ and lamellæ. It is terminated by a process which loses itself near the inferior median lobule.

3. OF THE CEREBRAL PROTUBERANCE, OR PONS VAROLII, CONSIDERED AS TO ITS EXTERIOR.

1441. This is the least voluminous portion of the brain, of which it forms as it were the centre, and of which it weighs only the sixtieth or sixty-fifth part. Its consistence is greater than that of the two preceding organs. Situated between the cerebrum and cerebellum, it has intimate connections with both, by means of strong prolongations. It is limited above, on the side next the cerebrum, by a circular groove or depression, broad and deep anteriorly, superficial and not very distinct posteriorly; and below, by a semicircular contraction where the spinal marrow commences.

It presents a pretty regularly quadrilateral form; its breadth is nearly equal to its thickness; and it is directed obliquely downwards and backwards.

1442. *Anterior Surface.* The anterior surface of the pons Varolii, which is named the *Commissure of the Cerebellum* by Gall, is directed downwards. It is convex, broader than the upper surface, and rests upon the basilar groove (228.) Like a portion of a ring, it embraces the peduncles of the brain, on which account it has been called the *Annular Protuberance.* It is marked along the median line by a broad groove, rounded at the bottom, and in which is placed the basilar artery. On each side, several other smaller grooves, approaching more or less the transverse direction, and more superficial, lodge the branches of the same artery.

1443. *Posterior Surface.* The posterior surface is directed upwards, and is almost entirely concealed by the inferior notch of the circumference of the cerebellum. It presents on its upper part four tubercles, which are white externally, gray internally, oblong, rounded, approaching each other in pairs, and separated by two grooves which intersect each other in a crucial manner. They are named *Tubercula Quadrigemina.* Of these four tubercles, which are seldom of equal size, the two upper, which are named *Nates* are larger, broader, and more prominent than the inferior, which bear the name of *Testes.* They are situated immediately behind the posterior commissure. The pineal gland corresponds to the point of the intersection of the two grooves. Below and without the inferior tubercles, there is observed, on each side, an elongated eminence which might be taken for a third pair of tubercles, and which is prolonged towards the root of the optic nerve. Behind the tubercula quadrigemina, is a pulpy lamina, of a grayish colour, very thin, and easily torn, which ascends towards the cerebellum and forms the vault of the fourth ventricle. This is the *Valvula Vieussenii.* It appears composed of transverse fibrils and small laminæ of a grayish colour, which are intersected in their middle by a sort of longitudinal raphe. After passing beneath the anterior notch of the cerebellum, this lamina becomes broader, and a little thinner, and is united to the posterior wall of the fourth ventricle. By its sides it is evidently continuous with the superior peduncles of the cerebellum. Immediately beneath the point where it leaves the pons Varolii, there is observed an aperture which is the posterior orifice of the *Aqueduct of Sylvius*, by which the third and fourth ventricles communicate across the substance of the pons Varolii itself. Farther down, is a slightly excavated and nearly vertical surface, which constitutes the anterior wall of the fourth ventricle. It is covered with a layer of grayish substance, and separated in its whole length by a narrow angular groove, which commences at the aqueduct of Sylvius, and terminates in the spinal marrow opposite the atlas. This groove is commonly named the *Calamus Scriptorius*, on account of its forming an acute angle at its termination, having some resemblance to the point of a pen. Several white and very delicate oblique lines proceeding from above downwards and from without inwards, meet in this groove. They seem to be a kind of bands slightly applied upon the surface of the protuberance. Haller, Vicq d'Azyr and Soemmering, consider these white filaments as the commencement of the acoustic nerve; but as their number and direction vary much, and as they are sometimes wanting, Prochaska and Gall declare against this opinion. Of these striæ, however, the upper pretty generally go to the acoustic nerve, the middle and inferior to the cerebellum.

1444. The *upper extremity* of the Pons Varolii is broad and prominent, and forms a sort of rim whose sides are continuous with the peduncles of the brain. The *lower surface* is less voluminous and more rounded, and is separated from the spinal marrow by a transverse groove, which is produced, not by an interruption in the continuity of the cerebral substance, but by the thickness of the transverse layers of the cerebral protuberance itself. Its sides are united to the peduncles of the cerebellum.

4. OF THE MEDULLA SPINALIS, CONSIDERED AS TO ITS EXTERIOR.

1445. The *Medulla Spinalis* or *Spinal Marrow*, is a thick and long, irregularly cylindrical cord, which descends from the cerebral protuberance, within the vertebral canal, to the level of the first or second lumbar vertebra, and always in the adult lower than in the child. Its weight varies from the nineteenth part to the twenty-fifth part of that of the brain in the adult man. In the new-born child, it does not form more than the fortieth part. The weight diminishes proportionally by desiccation, much more than that of the other portions of the cerebral organ. Its volume varies in the different parts of its extent. It is very bulging at its commencement, which is only distinguished from the cerebral protuberance by a transverse depression. It then contracts much, and again enlarges at the middle of the cervical region. After contracting a second time towards the end of that region, it acquires more thickness at the upper part of the back, then diminishes in its lower part, to terminate at length by a kind of oval tubercle. It does not lie loose in the vertebral canal, nor is it applied against its bony surfaces; but it is constantly sustained in a fixed manner in the middle of that cavity, a little nearer the anterior wall however than the posterior. In the spinal marrow, there are distinguished a middle part or *body*, and two *extremities*.

1446. *Upper Extremity*, or *Medulla oblongata, (Bulbe rachidien*, Chauss.*)* It is contained within the skull, and forms a sort of bulging which extends from the pons Varolii to the great occipital hole. It contracts in proportion as it descends, and is slightly compressed from before backwards. Its *anterior surface*, which is broad and convex, and lies upon the occipital bone, is remarkable for four eminences symmetrically placed alongside of each other. Two of these eminences are internal, and are separated by a median groove, much deeper above than below, filled by the pia mater, and continuing over the whole anterior surface of the spinal marrow to its inferior extremity. These are the *Pyramidal Eminences* or *Corpora Pyramidalia*. They seem to arise from the inferior extremity of the pons Varolii, where they are broader and more prominent, and after a course of eight or ten lines, disappear insensibly in the tissue of the spinal marrow. Opposite the atlas no traces of them are observable. The two lateral eminences are named the *Olivary Eminences* or *Corpora Olivaria*, and are separated from the other by a slight depression. They are very firm, of an oblong form, prominent in their middle, rounded at their extremities, and are white on the outside.

The *posterior surface* of the upper extremity of the spinal marrow contributes to form the fourth ventricle, and is directly continuous with the pons Varolii, there being no line of separation interposed. It is hollowed in the median line by a part of the *calamus scriptorius*, which is closed below by a fold of the arachnoid membrane, and which terminates at the height of the occipital hole. On each side, there are observed two whitish oblong eminences, named *Corpora restiformia*, which contribute to the formation of the cerebellum.

1447. *Body of the Spinal Marrow.*—We have already made known the enlargements and contractions which it presents during its course (1445.) Its *anterior surface* corresponds to the bodies of the vertebræ. It presents a great number of transverse small folds or grooves, more or less near to each other, particularly apparent from the last cervical vertebra to the ninth dorsal. A very deep and distinct fissure runs along its whole extent, dividing it into two equal lateral portions. Its *posterior surface* also presents transverse folds; but they are less visible than on the anterior. It also is divided in its whole length by a median groove which commences between the two corpora restiformia. It is closer on its edges, narrower and less deep than the anterior, especially in the adult. These two median grooves, according to M. Chaussier's observation, from whom we borrow several important details, receive a fold of the proper membrane of the spinal marrow, and serve for the transmission of a great number of vascular twigs, which penetrate by a multitude of small holes into its substance, and are there subdivided. In the bottom of each of them, there is seen a layer of white substance. In the posterior, this substance is formed by two longitudinal bundles. In the anterior, it is formed by transverse filaments which cross each other in the median line, and it presents a greater degree of thickness in the neck than in any other part of its extent. By the disposition of these grooves, the organ is deeply divided in its whole length, and as it were separated into two thick cords intimately united in their whole extent.

1448. On the anterior and posterior surfaces of the body of the spinal marrow, on either side, and at some distance from the median groove, are the collateral grooves, which are superficial and pretty broad, and in which are inserted the roots of the spinal nerves. The posterior, which are more marked, have rounded and very white edges, and a reddish bottom formed by a very soft substance. They commence by a rather indistinct line between the olivary eminence and the restiform body, and become broader and deeper as they descend. From the axis to the ninth dorsal vertebra, they are half a line in breadth. Each of them divides into two parallel lines, separated by the white substance, which are gradually lost upon the inferior extremity. In their whole course, they present a series of small holes regularly disposed one above the other, in which the roots of the nerves were inserted.

The two anterior collateral grooves commence between the corpora pyramidalia and olivaria. They are less apparent, narrower and more superficial. Their bottom is less red, firmer, and more dense.

These grooves are much more distinct in newly-born children than in adults.

1449. The *lateral surfaces* of the body of the spinal marrow correspond to the base of the transverse processes. They are narrower and rounded. No trace of groove or longitudinal division is perceived upon them, although some anatomists maintain the contrary.

1450. The *inferior extremity* of the spinal marrow presents two bulgings, of which the upper is larger and of an oval form, the inferior smaller and conical.

5. INTERNAL ORGANIZATION OF THE BRAIN IN GENERAL.

1451. The substance of the brain is soft and pulpy; but its consistence varies according to the age. It is almost fluid in the fetus, and becomes gradually firmer as the person advances in life. Its specific gravity, in the adult, is 1310. Its odour is somewhat nauseous, tenacious, soluble in water, insoluble in alcohol and oils.

This substance is not homogeneous throughout, but presents two distinct modifications;

1452. 1st. A soft, spongy, and seemingly vascular substance, of a grayish colour, named the *Cineritious* or *Cortical substance*, most commonly forming a kind of superficial envelope to the different parts of the organ, but also distributed through different parts of its interior, and sometimes mixed in a more or less intimate manner with the white substance. This pulp, which is the least consistent of all the solid parts of the body, and is not possessed of any very evident organization, receives a considerable quantity of arterial vessels. It is reddish in children, ash-gray in old people, pale and colourless in dropsical persons; these appearances no doubt depending upon the greater or less quantity of blood distributed to it. In some places of the brain which we shall presently make known, this substance acquires a dark or yellow tint, and this circumstance has induced Soemmering and Gennari to admit in the composition of the brain two particular substances, the one *black* and the other *yellow*, which however have not been adopted by other anatomists. Its colour is destroyed by maceration in water, acids or alcohol. By boiling in water or oil, it assumes a granular appearance. It is of the same nature in the brain and cerebellum.

When examined with the microscope, it appears composed of an immense quantity of irregularly rounded globules, of unequal size, and eight times smaller than the globules of the blood. They are connected with each other by a very delicate transparent tissue, filled with a very abundant serous fluid, and appear as if heaped together in a confused manner. It is in this part of the substance of the brain that the most minute arterial branches and veins are found.

1453. 2d. A *White* or *Medullary substance*, firmer, denser, and less plentifully supplied with fluid than the former, which makes it resist putrefaction a little better, and prevents it from losing more than six-tenths of its weight by desiccation, while the other loses eight-tenths. Its mass is also much greater than that of the cineritious substance, and it especially occupies the interior of the base of the organ. It is filled with a prodigious quantity of very delicate vascular ramifications, whose section represents so many red dots, and whose calibre is much greater towards the centre than at the circumference of the brain. It evidently becomes fibrous in many places. The globules of which it is composed appear, under the microscope, disposed in straight lines, and are of a larger diameter than in the cineritious substance. There is much variance in the opinions respecting its intimate structure. Some maintain it to be solid, others tubular; some assert that it is absolutely destitute of vessels, others that it entirely consists of them.

Some consider it as medullary. Drs. Gall and Spurzheim, with M. Bauer and Sir Everard Home, adopt the opinion of those who, like Haller, Malacarne, Monro, Soemmering, Vicq d'Azyr, Meckel and Wenzel, thought it fibrous, and we consider it in the same light.

1454. The idea most generally adopted with respect to these two substances, is that the first, which is of an almost entirely vascular nature, is a secreting organ, and that the other is a mass of excretory vessels, or at least of conducting filaments; that the nerves are bundles of these vessels; that the spinal marrow is itself one of these bundles, only larger than the rest. Of late years many physiologists have, with more reason, considered the nervous system, in its collective capacity, as a net work of which all the portions participate of the organization and functions of the whole, and not as a tree divided into branches and twigs. This is Dr. Gall's opinion; but he thinks moreover that the gray matter is the *matrix of the medullary filaments.* Wherever it exists, it arises from these filaments. Whenever a medullary bundle traverses the cineritious matter, it is enlarged by the filaments which it gives it, and none of these bundles enlarges without the concurrence of that matter. He regards the spinal marrow, not as a bundle of nerves descending from the brain, but as a compound of cineritious substance which bulges at the level of each pair of nerves, and gives rise to the white filaments which are to form it by their aggregation. He also demonstrates that the brain and cerebellum are themselves only developments of bundles coming from the spinal marrow, to which are annexed other masses of white fibres proceeding from the gray layer which envelopes the hemispheres. Lastly, he compares this latter to the ganglia diffused through the whole body; and, according to him, it forms in the brain several of these ganglia which we shall presently describe.

1455. These two substances of the brain do not form a pulpy mass disposed at random. Besides the shades of colour which they present, they are seen in certain places to affect determinate forms, always the same in the different individuals, and very regular. They are seen to form eminences, cavities, laminæ, partitions, &c. all differing in their volume, position, tint, consistence, &c. Most commonly, for the purpose of studying these different parts, horizontal, oblique, or vertical sections are made of the brain and cerebellum, which are repeated at different heights. But in this manner, the true relations which they have to each other, and their intimate structure, escape us. In fact, with a little attention, we come to discover that all of them direct themselves toward certain common points of origin, and that they are nowhere isolated from each other. We shall therefore follow a particular method in the study of the brain considered as to its interior, and this method will be the result of the combination of the different modes hitherto employed in the dissection of that organ.

6. STRUCTURE OF THE SPINAL MARROW IN PARTICULAR.

1456. The consistence of the substance which forms the spinal marrow varies much, according to age and some particular circumstances. In the adult it is generally less firm than the tissue of the cerebral protuberance, but denser than the cerebrum and cerebellum, although after death it alters much more promptly, and seems to liquefy almost at the moment. This organ ought, therefore to be dissected in very fresh subjects, or in children, in which its consistence is greater than in advanced age. M. Chaussier has also observed, that in women its softness is greater.

1457. At the exterior, the spinal marrow presents a layer of white substance, more or less pulpy, half a line thick, which seems excavated for the purpose of containing the cineritious matter, which is so much the more abundant the younger the subject is. This cineritious matter may be divided into three portions, a middle and two lateral. The first is transverse, thicker and broader in the neck, thinner and narrower in the back, and again more voluminous, but not broader, in the lumbar region. The two lateral portions are curved in such a manner as to be opposed by their convexity, while their concavity is directed outwards. The posterior edge is prolonged as far as the posterior collateral grooves, (1447;) the anterior is rounded and thicker. These two portions are more developed in the upper part of the neck; they then diminish as far as the lower part of the dorsal region, where they are manifestly enlarged.

1458. The olivary eminences (1446) are enveloped, like the rest of the spinal marrow, with a white external layer. If it be removed, a firm and dense oblong nucleus is found, which may be separated from the neighbouring parts, and which is surrounded, in its whole circumference, by a yellowish flexuous line. On making a transverse section of the olivary eminences in the plane of their thickness, there is obtained in the centre of each of them a kind of *dendritic* figure *(corpus dentatum,)* terminated by a foot or stalk at the anterior median groove, and formed by these nuclei of gray matter.

1459. Several anatomists assert their having found in the centre of the spinal marrow a central canal, which descends more or less, and is the continuation of the *calamus scriptorius.* M. Chaussier considers its existence as owing to the means employed for demonstrating it. But recently, Drs. Gall and Spurzheim have met with a canal in each of the lateral halves of the spinal marrow, especially in new-born infants. These canals commence in the lumbar regions, and are continued into the cerebral protuberance, under the tubercula quadrigemina, into the peduncles of the brain, and as far as the optic thalami, in the interior of which they form a cavity, which, on being blown into, is large enough to hold an almond. I have traced them in two subjects with much success.

7. STRUCTURE OF THE BRAIN IN PARTICULAR.

1460. All the bundles of medullary fibres which, by their expansion, are intended to form the brain, are placed at the upper part of the spinal marrow, *(Medulla oblongata.)* They are especially the anterior pyramidal eminences and the olivary eminences. With respect to the former, there is a very remarkable peculiarity to be observed, which is, that they do not contribute to form the brain on the same side as that on which they originate. Thus the inferior fibres of the anterior pyramidal body of the right side, for example, unite in small bands, whose number varies from two to five, at about fifteen lines beneath the cerebral protuberance. These bands proceed toward the left side, which in like manner sends some to the right side, but in such a manner that one of them passes most commonly above another, and beneath a third, whence there results an interlacement resembling mat-work, and from three to four lines in extent, above and beneath which there occurs a transverse cord, more or less apparent. After they have thus crossed each other, the bands ascend upon the anterior surface of the upper extremity of the spinal marrow, (1446,) progressively acquiring more volume, so as to be broader above than below, and it is this that produces the form of pyramids. The latter are a little contracted at their meeting with the cerebral protuberance, and in their passage frequently send off some fibres which turn round the olivary bodies.

1461. The anterior pyramids soon penetrate into the cerebral protuberance, and immediately divide into a considerable number of bundles immersed in the cineritious substance, which itself gives rise to new bundles which join the first and reinforce them. They all follow different directions. They are stratified, or interlaced with each other, and with the fibres of the anterior surface of the protuberance (1442.) At length they unite, and are seen emerging upon the sides of the upper extremity of this portion of the brain, and forming at the inferior surface of the cerebrum the greater part of two broad and thick white fibrous cords, which, from being at first very close to each other, proceed forwards and outwards, diverging and increasing in size, and which are named the *Peduncles of the Brain* or *Crura Cerebri*. The fibres of these peduncles are longitudinal, fasciculate, very apparent externally and anteriorly. At their lower surface, they leave between their intervals, more or less marked striæ, which are filled up with cineritious matter. They are themselves connected together, in the middle, by the white lamina which forms the floor of the third ventricle. They contain, in their interior, cineritious matter, which has a deeper tint than that of the rest of the brain, and is often blackish. Its consistence is also firmer. Its transverse section forms a semilunar spot. This substance furnishes them with new fibres in their passage, which continually augment their volume. Their outer edge corresponds to the optic nerve which turns round them, and is attached to them anteriorly by a layer of soft substance. From this place the medullary filaments of the peduncles of the brain separate from each other and expand. They form layers of unequal length, whose extremities are covered by cineritious substance, and which constitute the centre of each of the inferior, anterior, and external circumvolutions of the anterior and middle cerebral lobes.

1462. The olivary eminences emit from their upper part a fibrous bundle which unites with some other bundles arising from the sides of the spinal marrow, and ascends, like those of the anterior pyramidal bodies, across the fibres of the anterior surface of the cerebral protuberance. During this passage, it does not increase in size in so distinct a manner as the preceding bundles, and it forms the posterior and inner part of the same cerebral peduncles. It there meets with a large mass of cineritious matter, receives new filaments from it, which follow various directions in its interior, and constitute the *Thalami Nervorum Opticorum* of authors, named by Soemmering the *Colliculi Nervorum Opticorum*, and by Gall the *Inferior Great Ganglia of the Brain.*

1463. These thalami of the optic nerves are invested with a white substance. More voluminous behind than before, they correspond partly in the lateral ventricles, partly in the third, and partly at the exterior of the brain. Their figure is rounded and irregular. Their *upper surface* forms a part of the floor of the lateral ventricles. It presents a slight depression in its longitudinal direction, and a small ovoidal tubercle at each of its extremities. The *inferior surface* presents externally two prominences, the *Corpora Geniculata*, which furnish several filaments to the optic nerves, and is seen at the inferior surface of the cerebrum, above the meninges. The *inner surface* constitutes the lateral walls of the third ventricle. It is flat, directed obliquely from within outwards, and from above downwards, and is connected anteriorly with that of the opposite side by a transverse band of a gray colour, very easily broken, varying in form and size, and to which the name of *Commissura Mollis* has often been given. The *outer surface* is confounded with the corpus striatum, of which we shall presently speak. Their *anterior extremity* contributes to the aperture of communication of the lateral ventricles and third ventricle. The *posterior*, which is free, and contiguous to the fimbriated body, corresponds to the curve of the lateral ventricles.

It is between the bundles which proceed from the corpora pyramidalia and olivaria, in the very midst of the peduncles of the brain and optic nerves, that the upper part of the canals is observed, which prevail along the spinal marrow (1459;) and as these bundles change their direction in the course of their progress, the anterior passing outwards and the posterior inwards, the direction of this part of the canal also experiences a marked deviation.

1464. Before and to the outside of the thalami of the optic nerves, the fibrous bundles of the corpora olivaria meet a new mass of cineritious substance, are expanded and acquire a fresh augmentation from it, and form together with it the *Corpora Striata*, of which there are two, one on each side of the brain. These bodies are pyriform eminences, broad before, contracted behind, and placed obliquely, so that while they are very near each other anteriorly, they are widely separated posteriorly. Their colour at the outside is gray, somewhat tinged with brown. There are observed at their surface very remarkable venous ramifications, which are the radicles of the *Venæ Galeni*. The corpora striata form part of the floor of the lateral ventricles. They are contiguous with the corpus callosum by their upper surface, and with the septum lucidum by the inner. On cutting them obliquely and at different heights, the cineritious and medullary substances are seen disposed in their interior in alternate streaks, of variable form and breadth. With a little care, it is observed that all the white bands are continuous with the original bundles of the corpora olivaria.

1465. Between the optic thalami and the corpora striata, in a groove by which they are separated, there is observed a small slip of thin, fibrous, semi-transparent whitish substance. This is the *Tænia semicircularis*. It commences at the anterior extremity of the optic thalamus, sometimes by several filaments, sometimes by a single cord. At this place, its fibrous texture is very apparent, and it is a line and a half or two lines in breadth. From thence it ascends over the thalamus, passes over several of the veins which come from the corpus striatum, and allows them to be seen on account of its transparency. It then proceeds backwards, gradually contracts, is curved downwards, and loses itself towards the *Corpus geniculatum externum* (1463.) Anteriorly, it is itself covered by a small transparent and very delicate lamina of a yellowish colour. This is the *Horny Lamina* of the *Tænia semicircularis*, beneath which there is often observed a little serous fluid of the colour of amber.

1466. On leaving the corpora striata, the bundles of the olivary eminences expand into layers like those of the pyramidal bodies. Like them also, they form circumvolutions, and it is of these circumvolutions collectively that the posterior lobes and the vault of the hemispheres of the cerebrum are composed. Each circumvolution is not formed by a single bundle, but consists of two different layers which touch each other, and are but very slightly agglutinated. The cineritious substance invests its periphery. With a little care and patience, the presence of these two layers and their separation in the median line of each circumvolution can be demonstrated. It is in this that the art of *unfolding* the brain consists.

1467. We have seen how the cerebral hemispheres are formed by divergent bundles of fibres; but all the parts of one of these hemispheres are made to communicate with the corresponding parts of the other by a new order of white medullary convergent fibres, which come from the gray matter that envelopes the cerebral circumvolutions externally, and constitute different *commissures.* These commissures belong both to the upper and to the lower circumvolutions; and we now proceed to their examination.

1468. At the bottom of the superior circumvolutions, the converging filaments are seen forming a sort of tissue with the diverging filaments, uniting into larger and larger filaments, and lining the roof of the lateral ventricles, to emerge by the inner and lower edge of the hemispheres and form the *Corpus callosum (maxima commissura cerebri*, Soemm. *Mesolobe*, Chauss,) which is distinctly perceived at the bottom of the great interlobular fissure.

1469. The *Corpus callosum*, or *Mesolobe*, is therefore a long and broad band of soft and fibrous medullary substance, of a quadrilateral form at first sight, but curved forwards and backwards upon itself. Its direction is horizontal, its breadth greater behind than before, its situation such that it is a little nearer the anterior than the posterior part of the brain. It is only a few lines thick. Its *upper surface* is in part concealed by the hemispheres, which advance above it, forming a kind of oblong cavity, of which we have already spoken (1435.) It is convex from before backwards, plain in the transverse direction. In its middle, following the course of the median line, is a prominent longitudinal line, of a more compact tissue, which penetrates the whole thickness of the organ, and which is commonly called the *Raphe.* On each side of this raphe, which corresponds to the inferior edge of the falx cerebri, there is observed a filament, which is also longitudinal, and which is separated from it by a small flexuous groove. This filament is the trace of the arteries of the corpus callosum. Sometimes on the anterior part of that body, these filaments, which are by some authors called the *Longitudinal Nerves* of *Lancisi*, and which are always convergent, unite into a single line. More externally is a surface of greater extent, and apparently smooth, but in which a closer inspection discovers a number of prominent lines, more or less transverse, more distinct posteriorly, and terminating at the raphe, near which they are inflected towards the lateral ventricles. These lines are named the *Transverse Medullary Traces.*

1470. The *inferior surface* of the corpus callosum is visible and free over a much greater extent than the upper. At the sides it contributes to form the upper wall of the lateral ventricles. In the middle, it covers the fornix or three-pillared vault, with which it is directly continuous behind, and from which it is separated anteriorly and at the middle by the septum of the ventricles.

1471. At its *anterior extremity*, the corpus callosum is reflected from before backwards, and from above downwards, between the two hemispheres, where it forms a sort of rounded prominence. It extends and is prolonged as far as the base of the cerebrum, towards the fissura Sylvii, near the origin of the olfactory nerve, embracing the fore part of the corpora striata, and forming the anterior region of the floor of the lateral ventricles. In this course, it receives the converging fibres of the inferior circumvolutions of the anterior lobe. Lastly, it terminates by a sort of white streak which loses itself in the fibrous tissue of the peduncles of the brain.

1472. At its *posterior extremity*, the corpus callosum is also reflected, from behind forwards. It there forms a white lamina which is prolonged into the lower part of the lateral ventricles, and which invests in particular, on each side, a kind of circumvolution formed by the cineritious substance. This is what is called the *Cornu Ammonis* or *Pes Hippocampi.* This voluminous projection is curved upon itself, in such a manner as to present its concavity inwards and forwards, and its convexity outwards. Arising from the place where the corpus callosum bends, it first proceeds outwards, then forwards, becoming continually broader, and at length terminates by a broad and thick bulbous extremity, turned inwards, and surmounted by two or three more or less prominent tubercles, which are separated by distinct but rather shallow grooves. The *upper surface* of the Cornua Ammonis is free in the bottom of the ventricles, and covered by the choroid plexus. Their *convex edge* is circumscribed by a very distinct groove, behind which the substance which forms the bottom of the ventricles presents a bulging, which follows the direction of the cornua ammonis, and is sometimes equally large. This bulging is named the *Additamentum pedum Hippocampi.* Their *concave edge* is covered by the corpus fimbriatum, under which there is found a denticulated cord, of a compact tissue, granulated appearance, and reddish colour, and of which few authors have made mention. It is named the *Portion godronée* by Vicq d'Azyr.

The mass of cineritious substance which occupies the interior of the cornu Ammonis bifurcates at its posterior extremity, under the fold of the corpus callosum. One of its branches communicates with a circumvolution of the posterior lobe; the other, which is shorter, is confounded in one of the circumvolutions of the middle lobe.

In its course backwards, from the moment when it recurvates, the corpus callosum receives the convergent filaments of the inner circumvolutions of the posterior lobes of the brain.

1473. We have already mentioned (1469) that the transverse fibres of the corpus callosum bend over the sides of the raphe to proceed downwards. It is probable that by their still further prolongation is formed the *Septum lucidum* or *Septum of the Ventricles*, a kind of thin, lamellar, soft production, which is continuous above with the middle part of the inferior surface of the corpus callosum, in its whole extent, and which, inferiorly and posteriorly, is connected with the fornix, and inferiorly and anteriorly, with the recurved lamina of the anterior extremity of the corpus callosum. It separates the two lateral ventricles from each other. It is very high at its fore part, and progressively diminishes backwards, so that its two lateral surfaces are triangular. They correspond posteriorly to the optic thalami, and anteriorly to the corpora striata.

This septum is composed of two laminæ of fibrous white substance, lined in their whole extent by the arachnoid membrane, and only applied against each other. There exists a separation between them, which is more or less apparent in different subjects, and is often much greater in the fetus than the child, and in the latter than the adult. It is cordiform in the earliest stage of life, an elongated slit in old persons. It is sometimes filled by a pretty abundant serous fluid. This separation is the *Fossa Sylvii (Fifth Ventricle*, Cuvier; *Sinus of the Median Septum*, Chauss.) It is doubtful whether it is lined by a membrane or not. The brothers Wenzel think it is, and in certain cases of disease flakes may easily be raised from it. With respect to its alleged communication with the ventricles, the same anatomists have discovered, at its posterior extremity, a small fossa, the extent of which is not always in relation to that of the principal cavity. It is triangular or cordiform, and a bristle passed into it, penetrates into the third ventricle. But in the natural state, the aperture which affords a passage under the anterior commissure cannot be discovered.

1474. Beneath the corpus callosum and the septum of the ventricles, there is observed the *Fornix* or *Three-pillared Vault*, formed by the converging filaments of the posterior circumvolutions of the middle lobe. This is a lamina of soft, white, fibrous substance, having the form of a triangle curved upon itself, and whose summit, which is directed forwards, is bifurcated. It forms part of the two lateral ventricles and of the third ventricle. Its *upper surface* is, in a great part of its extent, contiguous to the corpus callosum. In the median line, it is continuous with the septum of the ventricles. The *inferior surface* is applied upon the tela choroidea and the optic thalami. Its two edges are coasted, in their whole extent, by the choroid plexus. Posteriorly, it presents a few striæ or prominent lines, more or less oblique with respect to each other. This is the *Lyre*, or *Corpus Psalloides*, and is considered by Dr. Gall as the general union of the communicating filaments of the fornix. The *anterior extremity*, *anterior pillar* or *peduncle* of the fornix, is divided into two cylindrical bundles, at first contiguous to each other and curving around the striated bodies to proceed directly downwards, then separating a little, sinking into the substance of the circumvolutions, and terminating at the pisiform tubercles of the inferior surface of the brain, after passing behind the anterior commissure. Behind each of these cords, and under the origin of the tænia semicircularis, is an oval aperture, more or less wide, by which the lateral ventricles communicate with the middle ventricle, and by which also the choroid web is continued into the choroid plexus.

1475. The *posterior angles*, *peduncles* or *pillars* of the fornix, furnish each a prolongation, which is bifurcated. One of the branches, which is very short and thin, loses itself in the white layer of the cornua Ammonis. The other, which is very long, and is named the *Corpus fimbriatum*, is a flattened band, which prolongs itself into the bottom of the lateral ventricles, turning over the concave edge of the cornua Ammonis (1472), and at length losing itself near the inferior aperture of the ventricles. Between this band and the optic thalamus, is a slit which opens in a fissure of the inferior surface of the cerebrum, and through which the pia mater penetrates.

1476. Beneath and behind the fornix, in the folds of the pia mater, and above the tubercula quadrigemina, is the *Pinéal Gland* or *Conarium*, a small grayish body, of the size of a large pea, varying in its form, of a soft and pulpy consistence, and everywhere isolated from the cerebral substance. Only at its fore part, where it is whiter, it receives two cords of medullary substance, the *peduncles of the pinéal gland*, which come from the upper and inner part of the optic thalami, where they form a slight prominence, proceed backwards, gradually increasing in bulk, pass over the sides of the posterior aperture of the third ventricle, and unite before attaching themselves to the gland, to which they stand in the same relation as the pituitary stem to the body of the same name. It ought also to be remarked, that it is between the pinéal gland and the choroid web that the posterior orifice of the arachnoid canal occurs.

The nature of this small body is unknown. It receives a considerable number of vessels. Very frequently, in the adult, it contains a remarkable quantity of small transparent calculi, very hard, and of a siliceous aspect, varying much in their number and disposition. They are generally collected into a small quadrilateral mass (the *Acervulus* of Soemmering), under the choroid web, near the posterior commissure. At other times, they are irregularly distributed on the sides, or in the very substance of the organ. On examining the masses of these small concretions with the microscope, the brothers Wenzel supposed they discovered in them a proper membrane which connects them together. The larger among them are not formed of a single mass, but are the result of the agglomeration of several smaller ones. Their figure is irregular at first sight, but with a little attention, it is discovered that they are all round. Their surface is rough and dotted with points.

1477. The different parts which we have described above as existing in the exterior of the brain, are separated from each other in various places by cavities or intervals known by the name of *Ventricles of the Brain*. These are distinguished into *Lateral* or *Superior Ventricles*, of which there are two, and a *Middle* or *Third Ventricle*.

Recently (2d November 1824), M. Laurencet, of Lyon, has endeavoured, by *unfolding* the brain in a peculiar manner, to show that the ventricles of the brain do not really exist, and are merely the result of the approximation of the nervous membrane, which, according to him, constitutes the brain, and may be spread out without being obliged to tear it. Before we venture to pronounce on this subject, we shall wait the decision of the Royal Medical Academy of Paris, to the judgment of which M. Laurencet has submitted his opinions in a very well written memoir.

1478. Be this as it may, the *Lateral Ventricles (Ventriculi tricornes)* are two cavities of considerable extent, of a figure rather difficult to be described, and symmetrically disposed to the right and left in the substance of the hemispheres. They commence behind the fissura Sylvii, at about two inches from the extremity of each hemisphere, where they are an inch distant from each other. From thence they direct themselves upwards, backwards, and inwards, and are only separated by the *Septum lucidum.* They then proceed horizontally, and separating a second time, as far as the posterior part of the corpus callosum, whence they descend downwards, outwards, and forwards. Finally, they again approach each other inferiorly, and terminate behind the fissura Sylvii, under the point at which they commenced, and in the bottom of a groove of which we have spoken. At the place where the direction of these cavities is entirely changed, there is observed in the substance of the posterior lobe, a triangular prolongation, presenting its base before, and curved in such a manner as to have its concavity inwards. This is the *Digital* or *Ancyroid Cavity.* Each lateral ventricle, therefore, has the form of an italic *S* reversed Ƨ.

The *upper half* of the lateral ventricles is a little broader before than behind, and resembles the half of an elliptical vault. It is prolonged forwards into the anterior lobe by a small angular cavity, named the *Anterior Horn.* Above, it is formed by the inferior surface of the corpus callosum; below, by the anterior fold of the same body, the corpora striata, optic thalami, tænia semicircularis, and fornix; internally, by the septum lucidum; externally, by the tissue which the diverging and converging fibres of the cerebral circumvolutions form by intermingling.

The *Digital Cavity* or *Posterior Horn* is entirely lined by the medullary substance. On its inferior wall there is observed an eminence, broad before, narrow and pointed behind, curved inwards, and more or less prominent in different subjects. This eminence is named the *Unguis* or *Spur* (the *Lesser Hippocampus* of Vicq d'Azyr, the *Unciform Eminence* of Chaussier.) It is broad before, narrow and pointed behind, curved inwards, and more or less prominent in different subjects. It is sometimes divided by a groove, so as to appear double. Its structure is the same as that of the cornu Ammonis (1472.)

The *lower half* of the lateral ventricles, which occupies a part of the posterior lobe and the whole middle lobe, is a long narrow canal, longitudinally curved, and convex externally. Its walls are formed by the fimbriated bodies, the cornu Ammonis, its accessory, and a small grayish band.

1479. In their whole length, the lateral ventricles are divided by a slit whose direction is followed by the choroid plexus. This slit is formed between the optic thalami and the edges of the fornix above, between the optic thalami and the corpora fimbriata below. It commences on each side at the aperture of communication with the third ventricle, behind the anterior peduncles of the fornix, and terminates at the inferior surface of the brain, where it is closed by the arachnoid membrane, and where it receives prolongations of the pia mater and vessels. In its whole extent, it is strengthened by a fold of the inner arachnoid.

1480. Under the fornix, and between the two optic thalami, there exists another cavity which is named the *third* or *middle ventricle.* It is of much less extent than the preceding, is single, and placed in the median line. Its direction is horizontal, its greatest diameter from before backwards, and its form elliptical. Its upper wall, which is of less extent than the lower, is limited by the choroid web and the fornix (1474.) Its lower wall, which is very thin, forms part of the inferior surface of the brain. Posteriorly, it is formed by the medullary lamina which occupies the intervals of the two peduncles of the brain; more anteriorly, by the upper part of the pisiform tubercles; and at its foremost part, by the gray substance which occurs behind the commissure of the optic nerves. It is to be remarked that this part of the ventricle is concave, and that on account of the smallness of its breadth, it seems to form a small slit, of which the deepest part corresponds to the pituitary shaft, and which is named the *Infundibulum.* This infundibulum is never prolonged into the pituitary shaft, as some authors have alleged. The lateral walls of the middle ventricle are limited by the optic thalami, which are contiguous in the greater part of their extent, and united in one point, by a grayish band.

Anteriorly and below, this ventricle is closed by a membrane which rises from the commissure of the optic nerves (1436,) and presents at its level a kind of aperture which, since Colombo's time, has been generally called the *Vulva*, and on the sides of which are two holes which communicate with the lateral ventricles (1474.) Anteriorly and above, it is limited by the *Anterior Commissure*, a sort of whitish, transverse, cylindrical cord, situated immediately behind the anterior curve of the fornix, and of the size of the optic nerve. It is naturally free and apparent over an extent of about six lines at its middle part. But, on each side, it sinks deeply into the substance of the hemispheres, curving backwards in a sensible manner, and, according to Chaussier, reaches the corpus callosum and peduncles of the brain. These lateral portions are a little flattened, and more voluminous than the middle region.

Posteriorly and above, the third ventricle is limited by the *Posterior Commissure*, which is thicker and shorter than it, but of the same cylindrical form and transverse direction. Its fibrous appearance is also more distinct. By its posterior edge it is contiguous to the tubercula quadrigemina. Beneath it, is the posterior aperture of the ventricle, named the *Anus*, a sort of small narrow slit, furnished on the edges with a very thin white band. It is the anterior aperture of the *Aqueduct of Sylvius*, a cylindrical canal, formed obliquely in the substance of the cerebral protuberance, beneath the tubercula quadrigemina, and opening posteriorly into the ventricle of the cerebellum, under the valvula Vieussenii. Its surface presents inferiorly a groove which is continuous with the *Calamus Scriptorius*, and, on each side, one or two small inequalities.

8. STRUCTURE OF THE CEREBELLUM IN PARTICULAR.

1481. The bundles of convergent and divergent fibres are far from being so well demonstrated in the cerebellum as in the cerebrum. We cannot here adopt the method followed in the preceding article, but shall describe all the white substance of this organ as formed by fibres of the second kind.

1482. We have already said (1442) that the anterior surface of the cerebral protuberance is formed by a pretty thick layer of white matter, manifestly fibrous, to which the name of *Pons Varolii* or *Annular Protuberance* is given. This layer unites its fibres posteriorly and on each side into two thick divergent bundles, much more separated from each other than the peduncles of the brain, and diminishing in size in proportion as they proceed from the cerebral protuberance towards the cerebellum. These are the *Peduncles of the Cerebellum*. Each of them is convex and rounded externally.

The restiform processes (1446) form on each side a sort of prolongation, named the *processus ad Medullam Spinalem*, which, from the posterior surface of the upper extremity of the medulla oblongata, ascends upon the inner side of the peduncle of the cerebellum and unites with it.

Lastly, the white lamina which covers the tubercula quadrigemina also appears to be gathered posteriorly into two longitudinal bundles, named *Processus ad testes*, united together by the valvula Vieussenii, and applied upon the upper and inner parts of the same peduncle.

By their junction, these three productions appear to constitute a common trunk, in the middle of which is a kind of elongated ovoidal nucleus, circumscribed on all sides by a very distinct undulated line of a yellowish colour. This is the *Corpus dentatum* or *serratum*. It is a little nearer the upper than the lower surface of the cerebellum, and appears slightly compressed. Its tissue is firmer than that of the rest of the cerebellum; it is surmounted by several points, and traversed by some vessels; its colour is a little deeper than that of the ordinary gray substance. It is only seen with great difficulty in children. The white fibres cannot be traced into its interior, as in the optic thalami; and it seems to be isolated like the nucleus of the corpora olivaria (1458.)

1483. To the outside of the peduncles of the cerebellum, there are seen the appendix lobularis, and the trunks of the facial and acoustic nerves. Internally, that is to say between the two prolongations which ascend from the restiform processes, there is found the *Ventricle of the Cerebellum* or *Fourth Ventricle*, formed at once by the cerebellum, the corpus callosum, and the medulla oblongata. Its *anterior wall* is formed by the posterior surface of the latter, and presents the *Calamus scriptorius*, transverse white striæ, and the posterior orifice of the aqueduct of Sylvius (1443.) Its *lateral walls* are limited by the prolongations which come from the tubercula quadrigemina and corpora restiformia, which separate from each other as they ascend, so that the ventricle is broader above than below. Its posterior wall is shorter than the other, and is formed by a part of the anterior notch of the cerebellum. Its *upper extremity* is closed by the valvula Vieussenii (1443.) Its *lower extremity* is also closed, but by a dense and strong membrane, of a grayish colour, appearing to be continuous with the pia mater. The latter forms beneath it a small fold resembling the choroid web. There also occurs in this place a small mass of blood-vessels and reddish granulations, which is designated by the name of *Choroid Plexus of the Fourth Ventricle.* It forms a small three-lobed body, of which the middle lobe projects in the ventricle, while the two lateral, which are smaller and rounded, occupy the sides of the fissure which separates the cerebellum from the cerebral protuberance.

Between these two portions, at the extremity of the middle lobule of the cerebellum, in the substance of the fold of the pia mater, is a small conical tubercle, the *Laminar Tubercle of the Fourth Ventricle*, the summit of which is composed of several transverse and parallel laminæ, while its base is connected with the substance of the cerebellum by a peduncle. Moreover, on each side, it sends to the lobular appendage of the cerebellum (1439) a membranous fold, in the interior of which is a lamina of white substance, and of which the outer edge is concave, free and floating. This tubercle has a great resemblance to the pineal gland.

1484. Each of the peduncles having arrived at the centre of the corresponding hemisphere of the cerebellum, forms an elongated oblong mass, sending from its circumference a lamina into the centre of each of the lobules. These laminæ are much less distinct above than below, and especially than behind. Each of them is divided into several branches for each of the principal laminæ of the cerebellum, and these branches divide into ramuscules for the secondary laminæ. To this assemblage the name of *Arbor Vitæ* has been given. It is enveloped on all sides by the cineritious substance.

Moreover, the valvula Vieussenii and the two prolongations of the tubercula quadrigemina emit from their upper part various white laminæ, which are distributed in the central part of the cerebellum much in the same manner as the laminæ of the arbor vitæ are in each of the hemispheres. These ramifications are distributed into the laminæ of the vermiform process.

1485. The arteries of the cerebrum and cerebellum come from the internal carotid and vertebral arteries, from the latter of which arises the basilar artery, whose branches form with those of the carotid what anatomists have named the *Arterial Circle of Willis.*

The spinal marrow receives its arteries from the vertebral, dorsal, lumbar, and sacral arteries.

The encephalic veins have very thin coats, and enter the sinuses which are formed in the substance of the dura mater, which empty their contents into the internal jugular veins.

The sinuses of the spinal marrow terminate in the vertebral, dorsal, lumbar, and sacral veins.

No lymphatic vessels have as yet been discovered in the tissue of the brain.

9. OF THE MEMBRANOUS ENVELOPES OF THE BRAIN.

OF THE DURA MATER, OR MENINX EXTERIOR.

1486. The Dura Mater is the outermost membranous envelope of the brain. It is destined partly to support it, partly to isolate its different portions. It is common to that organ and the bones of the cavity which contain it, to which it seems to perform the office of an internal periosteum to a certain degree. It is a firm, thick, compact fibrous membrane, of a whitish pearly colour, semitransparent, and occupying the interior of the skull and vertebral canal.

1487. Its *outer surface*, in the skull, is applied on all sides upon the bones, which gives it an uneven and flocular appearance, from the great number of filaments and blood-vessels by which it communicates with them.

1488. It adheres but loosely to the broad and rather smooth bones of the vault of the skull, and is easily detached from the frontal, parietal, and occipital bones, as well as from the squamous portion of the temporal. At the sutures, however, its union is much more intimate, on account of the small filaments and numerous vessels which traverse them to join the pericranium, which is especially remarkable in the sagittal suture. On the vault of the skull, also, the dura mater sends a small fibrous canal through the parietal hole, which serves as an envelope to a small vein.

1489. At the base of the skull, the external surface of the dura mater is very complex in its disposition, on account of the great number of holes and inequalities which are observed in that region. It sinks into the foramen cœcum, (153,) where it contracts pretty intimate adhesions by several prolongations. It embraces the summit of the crista-galli of the ethmoid bone, whence it descends on each side into the ethmoid grooves. There, at each hole of the cribriform plate, (131,) it furnishes for each branch of the olfactory nerves a small fibrous canal, which terminates on the outer layer of the pituitary membrane. More laterally, similar canals penetrate into the internal orbitar canals to accompany the nerves and vessels which they contain, and are continued into the periosteum of the orbit. Lastly, altogether on the sides, the dura mater adheres but little to the orbitar arches, even at the place of the sphenoidal suture (197.)

1490. More posteriorly, it adheres in a more decided manner to the groove placed at the fore part of the supra-sphenoidal fossa, and penetrates into the optic foramina, forming an envelope for the optic nerves. This cylindrical envelope separates when it arrives at the posterior insertion of the recti muscles of the eye. Its outer lamina, which is rather thin, expands into the periosteum of the orbit; the inner, which is whiter, denser, thicker, and immediately applied on the nerve, accompanies it to the globe of the eye, and is continued into the sclerotic membrane.

Behind the optic hole, the dura mater presents a circular aperture which embraces the internal carotid artery at the moment when it issues from the cavernous sinus. Some fibres arising from the circumference of this aperture, seem to throw themselves into the walls of the artery. At its anterior part, there occurs the orifice of a small canal formed inferiorly between the two laminæ of the envelope of the optic nerve. It transmits the ophthalmic artery into the orbit.

The dura mater then lines the pituitary fossa (115,) where it is covered by the body of the same name (1432) which separates it from the arachnoid membrane at this place. It then passes over the sides of the body of the sphenoid bone, where it divides into two laminæ, to form the cavernous sinuses. The inner of these laminæ is thin, and immediately covers the cavernous groove; the outer, which is free, forms the opposite wall of the sinus.

1491. On the free edge of the processes of Ingrassias, the dura mater forms a small fold which enters into the fissura Sylvii; then, descending from thence vertically, it closes the sphenoidal fissure, and sends through it a prolongation, thicker on the inner side, which proceeds into the orbit, and is continuous with the periosteum of that cavity, which appears to be nothing else than an expansion of the dura mater. This prolongation presents several apertures for the passage of vessels and nerves which enter the orbit.

1492. The membrane then extends into the middle lateral fossæ of the base of the skull, to which it adheres but feebly; but, on approaching the sides of the body of the sphenoid bone, it furnishes first an envelope to the superior and inferior maxillary nerves in the bony canals by which they are transmitted to the outside of the skull. It also gives one to the middle meningeal artery, and concurs to form the cavernous sinus and various canals. One of the latter is for the common motor nerve of the eye. It commences a little before the posterior clinoid process. It is fibrous in its whole circumference, and invested by the arachnoid coat at the commencement of its course, but the latter afterwards leaves it to be reflected over the nerve, and there is no longer perceived a complete fibrous canal, but the lamina of the dura mater alone which forms the outer wall of the cavernous sinus is seen externally. Internally, the nerve is separated from the sinus itself only by a thin and apparently cellular membrane. Another canal belongs to the pathetic nerve. It is a little higher than the preceding, and much narrower, and like it is fibrous and lined by the arachnoid membrane in the first part of its course. Afterwards it is in like manner only formed by a single lamina of the dura mater applied externally upon the nerve, which is separated from the rest of the sinus by a thin and transparent membrane. Lastly, a little farther back and opposite the upper edge of the petrous process, the dura mater forms a canal for the trifacial nerve consisting of two laminæ. The upper of these laminæ is attached to the posterior clinoid process, and is continued over the upper edge of the petrous process. The other is placed between the nerve and the cavernous sinus, and becomes so thin as to be converted into a cellular lamella, which is prolonged internally of the ophthalmic branch. As it advances, the three nerves, the common motor, pathetic, and ophthalmic, are each engaged in a new portion of entirely fibrous canal, which is afforded them by the prolongation of the dura mater which passes from the sphenoidal fissure into the orbit.

1493. On the middle of the upper surface of the petrous process, the dura mater covers the superior filament of the vidian nerve, and may easily be detached from it.

1494. It then adheres pretty strongly to the upper edge of the petrous process and to the quadrilateral plate of the sphenoid bone. It descends from thence into the basilar groove, and is intimately attached to the occipital bone over the whole circumference of the foramen magnum. A little laterally, it presents for the external motor nerve of the eye a hole which is not succeeded by a canal, and which transmits it again into the cavernous sinus. The arachnoid membrane descends in it as far as that sinus, which it closes. It is then reflected upon the nerve. Farther on, and upon the posterior surface of the petrous process, the dura mater penetrates into the meatus auditorius internus, seems to enter the aqueduct of Fallopius, but cannot be followed into the foramina which are traversed by the filaments of the acoustic nerve. Farther down, at the level of the foramen lacerum posterius, it envelopes the glosso-pharyngeal, pneumo-gastric and spinal accessory nerves, and is continued into the periosteum of the outer part of the base of the skull. A thinner lamina surrounds the internal jugular vein. It also sends into the anterior condyloid foramen a fibrous canal which is in like manner continuous with the periosteum.

1495. Through the great occipital hole the dura mater passes into the vertebral canal, in the interior of which it forms an infundibuliform membranous sheath, rounded in its whole extent, narrower than the bony canal, and on the other hand much wider than the spinal marrow. Its *external surface* does not adhere to the vertebræ, from which it is separated by a reddish, adipose, loose, and filamentous cellular tissue, excepting anteriorly, where it contracts a pretty intimate adhesion to the posterior vertebral ligament (575.) On the sides, this membranous sheath furnishes a small canal for each nerve, at the moment when it issues through the corresponding hole of conjunction. These small canals are so much the longer, wider, and more oblique the lower they are examined. They are all obviously dilated in the interior of the hole of conjunction, on account of the small ganglion which is observed there. At the outside of the vertebral column, they lose themselves in the neighbouring cellular tissue, without being continued into the periosteum, as is the case around the skull. The meningeal sheath of the spinal marrow terminates inferiorly by five ligamentous filaments which fix it to the sacrum and coccyx.

1496. *Internal surface of the dura mater.* It is lined in its whole extent by the arachnoid membrane, which gives it a smooth polished and glossy appearance, and which adheres intimately to it, excepting at the middle of the sphenoid bone, where it is separated from it by the pituitary body. It gives rise to several folds, which are the *Falx Cerebri*, *Tentorium Cerebelli*, and *Falx Cerebelli.*

1497. *Falx Cerebri.* This is a kind of lamina which extends from one extremity of the skull to the other in the median line, broad behind, gradually contracting as it advances forwards, having a considerable resemblance to the blade of a sickle, and occupying the great interlobular fissure of the brain, so as to separate its two hemispheres from each other. Its *upper edge*, which is thick and convex, corresponds anteriorly to the frontal ridge, then in the middle to the sagittal suture, and posteriorly to the middle groove of the occipital bone. It lodges the superior longitudinal sinus. Its *lower edge* is free, concave, thin, and of much less extent. It is placed above the corpus callosum, which it touches posteriorly, and contains the inferior longitudinal sinus. Its *anterior extremity* embraces the crista galli; the *posterior* is continued into the tentorium cerebelli, and contains the straight sinus. In some subjects, the tissue of the falx is interrupted in its continuity, so that there are observed perforations in it varying in size and more or less irregular, and which seem to form meshes between its ligamentous bundles.

1498. *Tentorium Cerebelli*, or *Septum Transversum.* This is a kind of membranous vault which separates the cerebrum from the cerebellum, limited behind by the posterior fossæ of the base of the skull, and leaving anteriorly a semilunar aperture corresponding to the cerebral protuberance. Like the falx cerebri, it is in a state of continual tension, and is covered by the arachnoid membrane, which gives it a smooth and polished appearance. Its *outer circumference*, which is of much greater extent than the *inner*, corresponds posteriorly, where it is hollowed for the lateral sinus, to the edges of the lateral groove of the occipital bone, and anteriorly, to the upper edge of the petrous process, on which the superior petrous sinus occurs. Its *inner circumference*, which is much smaller, free, and nearly oval, forms in a great measure the circumference of the aperture of which we have just spoken, which is broader and more elevated behind than before. The *extremities* of the two circumferences of the tentorium cerebelli meet at an acute angle, are elongated, cross each other like the legs of the letter X, and pass over each other, on either side, to be attached to the two corresponding clinoid processes. The upper branch, which is especially continuous with the small circumference, is more marked than the other. It passes over the side of the pituitary fossa, augments its depth, and is inserted into the anterior clinoid process. The lower branch, which terminates the great circumference, completes the upper edge of the hole through which passes the trifacial nerve, proceeds obliquely inwards, and is attached to the posterior clinoid process.

1499. *Falx Cerebelli.* This is a small triangular lamina, pretty broad above, indistinct below, extended from the internal occipital protuberance to the occipital hole, at the fore part of the occipital crest, and placed between the two hemispheres of the cerebellum. Its *base* is continuous with the tentorium cerebelli. Its *summit* is bifurcated, and the two branches of this bifurcation are more or less prolonged upon the sides of the occipital hole.

1500. The dura mater presents no trace of muscular organization in any point of its extent. It is manifestly fibrous, as we have said, and its fibres are especially very apparent in the folds, and in particular at the upper part of the falx cerebri. Their direction is never constant or regular. They cross each other in various ways, or form oblique planes superimposed upon each other. The strength and denseness of this membrane are very remarkable. It does not appear to receive any nerves, excepting, as Chaussier remarks, some filaments which come from the system of ganglions, and accompany its arteries, which are pretty numerous, and have walls formed in its substance. They are the middle meningeal arteries furnished by the internal maxillary arteries, and many other smaller branches supplied by the anterior and posterior ethmoidal, the lachrymal, the inferior pharyngeal, the vertebral, the occipital, and the temporal arteries. It is moreover traversed in various points by venous canals, which are named the *Sinuses of the Dura Mater.*

1501. These canals, which are of variable dimensions, and disposed in a symmetrical and regular manner, have walls formed externally by the dura mater, and lined internally by a smooth and polished membrane, of a serous aspect, and which is met with in the interior of all the veins. Being constantly stretched in all points of their extent, they can neither change place, nor even contract upon themselves. Their cavity presents at intervals bridles which pass irregularly from one wall to the other, and which are generally formed by fibrous bundles of the dura mater. It is into the sinuses that all the veins of this membrane and all those of the brain empty themselves.

1502. *Torcular Herophili.* This is a smooth and polished cavity, of irregular form, placed at the union of the three great folds of the dura mater, on the fore part of the internal occipital protuberance. It is lined by the internal membrane of the veins, and presents six apertures; a superior, of a triangular form, belonging to the superior longitudinal sinus; two inferior, of variable form and breadth, corresponding to the occipital sinuses; an anterior, rounded, belonging to the straight sinus; lastly, two lateral, broader, but generally of different sizes, transversely oval, furnished with a thick rim in their contour, and leading into the lateral sinuses. The two last, and sometimes the two inferior, are destined to transmit to the outside of the cavity the blood which is poured into them by the others.

1503. *Superior Longitudinal Sinus, (Superior Falciform Sinus,* Soemm.) This is a long triangular canal, convex above, presenting its acute angle below, occupying the whole upper edge of the falx cerebri (1497.) narrow before, broader behind, commencing by a sort of cul-de-sac at the fore part of the crista-galli of the ethmoid bone, and corresponding to the frontal ridge, the sagittal suture, and the vertical groove of the occipital bone. In its interior, it is smooth and polished in its whole extent, and presents a considerable number of those bridles, of which we made mention above, which are invested, like it, by the internal membrane of the veins. This sinus communicates above with the frontal veins by a certain number of little veins which pass through the sagittal suture, it also receives, in the same direction, veins which come from the diploe of the bones of the upper part of the skull. It also communicates, by means of a small branch which passes through the parietal hole, with the veins on the outside of the head. Lastly, it receives some trunks from those of the dura mater, and all those which are expanded over the convex and plain surfaces of the two cerebral hemispheres. They almost all open into its interior obliquely forwards. In general, the mouths of the veins are covered in a great measure by membranous folds in the form of valvules, and whose free and concave edge is turned forwards. All these folds are formed by the internal membrane of the veins applied upon itself, and are in general much less visible in the anterior region of the sinus than in the posterior. It is also probable that, by its anterior extremity, the superior longitudinal sinus often communicates with a vein of the nose which passes through the foramen cœcum (223.)

1504. *Inferior Longitudinal Sinus (Inferior Falciform Sinus,* Soemm.) Much narrower than the preceding, occupying the lower edge of the cerebral falx, from its anterior third to the tentorium cerebelli, it seems to result from the union of several small veins of the falx itself, and generally terminates by two branches in the straight sinus. Of these branches, one is directly continuous with it above the aperture of the venæ Galeni; the other ascends in the substance of the falx for some time, curves backwards and downwards, and penetrates obliquely into the straight sinus towards the middle of its length. The latter only is furnished with a valvular fold.

1505. *Straight Sinus (Fourth* or *Perpendicular Sinus,* Soemm.) Triangular in its whole extent, broad behind, contracted before, passing a little obliquely downwards and backwards; it prevails all along the base of the falx, above the tentorium cerebelli, from the termination of the inferior longitudinal sinus to the torcular Herophili. In its interior, it presents the same appearance as the superior longitudinal sinus: that is to say, upon its walls a great quantity of fibrous bundles, closer to each other before than behind, form remarkable prominences beneath the delicate membrane which covers them. It receives the inferior longitudinal sinus, as we have already said. The veins of the cerebral ventricles or the venæ Galeni empty themselves into its anterior and inferior part, presenting a valvular fold. Towards the middle of its length and inferiorly, the straight sinus still receives the blood of the superior veins of the cerebellum, through a rounded separation of the fibres of the dura mater.

1506. *Occipital Sinuses (Posterior Occipital Sinuses,* Soemm.) These sinuses commence on the sides of the foramen magnum, not far from the termination of the lateral sinuses, with which they sometimes communicate, and ascend, becoming broader, and drawing nearer each other, into the substance of the falx cerebelli, where they pretty frequently unite altogether. They open, each by itself, into the base of the torcular Herophili. They receive the veins of the falx cerebelli, of the dura mater which lines the inferior occipital fossæ, and those of the posterior part of the cerebellum.

1507. *Lateral Sinuses (Transverse Sinuses,* Soemm.) They conduct the blood from the torcular Herophili to the foramen lacerum posterius, into the sinus of the jugular vein. Their course is marked by a groove which exists on each side of the interior of the skull (229.) A difference of capacity is almost always observed between them, the sinus of the right side being generally larger. From the torcular Herophili to the upper edge of the petrous process, they have a triangular form; in the rest of their course, their section is elliptical. Their interior, which is everywhere smooth and polished, presents none of the bridles of which we have made mention in speaking of the other sinuses. They receive some veins from the cerebellum, the posterior extremity of the cerebral hemispheres, the tentorium cerebelli, and the cavity of the tympanum. They also present in the second part of their course the orifices of the superior and inferior petrous sinuses, which carry the blood from all the other sinuses of the base of the skull. By the mastoid and posterior condyloid foramina, they communicate moreover with the occipital veins on the outside of the skull.

1508. *Coronary Sinus (Circular Sinus*, Soemm.) It surrounds in a more or less regular manner the pituitary fossa and body, passing behind the channel of the optic nerves and before or above the quadrilateral lamina of the sphenoid bone. It is very narrow in its whole course; and it receives the venules of these different parts and those of the neighbouring portion of the dura mater, and opens to the right and left into the cavernous sinuses.

1509. *Cavernous Sinuses.*—These sinuses are much more complicated than all the rest. They commence beneath the anterior clinoid processes, behind the inner third of the sphenoidal fissure, proceed from thence horizontally backwards upon the sides of the pituitary fossa, whence they descend into the place which separates the summit of the petrous process from the quadrilateral plate of the sphenoid bone. There they terminate by emptying themselves into the superior and inferior petrous sinuses. Their breadth is considerable, and they are lodged in the lateral grooves of the body of the sphenoid bone, between two laminæ of the dura mater. Of these two laminæ, by an arrangement already partly described (1490,) the inner immediately lines the bony surface, and is prolonged into the sphenoidal fissure; while the other, which is much thicker, forms the outer wall of the sinus, which contains in its substance the common motor, the pathetic and ophthalmic nerves, and closes the two outer thirds of the sphenoidal fissure, becoming confounded above with the extremities of the tentorium cerebelli (1498,) which contain the sinus in that direction. Altogether internally, the latter lamina is united with the first. The cavity of the cavernous sinuses generally presents a great number of soft reddish filaments, interlaced and as it were reticulated. The intimate nature of this kind of cellular structure is very difficult to be determined. It appears to me to be evidently formed at once by nervous filaments of the superior cervical and cavernous ganglions, the fibres of the dura mater, and the folds of the internal membrane of the veins. There are moreover met with, in the interior of these same sinuses, the internal carotid artery and the external motor nerve of the eye, placed against their inner wall, and immersed in the blood, from which they are only separated by the delicate internal membrane of the veins which envelopes them.

The cavernous sinuses receive a great number of meningeal veins, the ophthalmic veins, whose roots originate in the interior of the eye and orbit, several emissary veins which traverse the sphenoid bone, and the two coronary sinuses.

Beneath the pituitary body the two cavernous sinuses have a very distinct communication, which forms the *Sinus transversalis Sellæ equinæ* of Haller.

1510. *Superior Petrous Sinuses.*—They seem to arise from the termination of the preceding sinuses, towards the summit of the petrous process, whose upper edge they follow, lodged in a pretty distinct groove, and in a part of the great circumference of the tentorium cerebelli. They pass above the trifacial nerve, and at its level leave for a moment the groove of the temporal bone. They are less broad but longer than the inferior. They open into the lateral sinuses, towards the point where the latter experience a curvature. They are triangular in their interior, and present but very few transverse bridles.

1511. *Inferior petrous sinuses.* They arise from the cavernous sinuses at the same point as the preceding, with which they communicate at the moment of their commencement, descend behind and to the outside of the inferior edge of the petrous and basilar processes, and terminate in the lateral sinuses at the level of the sinus of the internal jugular vein. They are broader at their extremities than at their middle part, and present the same structure as the superior petrous sinuses. Their inner wall, that which is immediately applied upon the bone, appears to be formed only of the internal membrane of the veins, no lamina of the dura mater being perceived upon it.

The two kinds of petrous sinuses receive veins of no great importance, all of which come from the dura mater. Some of them traverse the bones and communicate with the outside of the skull.

1512. *Transverse Sinus (Anterior occipital sinus,* Soemm.) Placed transversely at the upper part of the basilar process, it forms a communication between the union of the two petrous sinuses and cavernous sinus of the one side with that of the other. It varies in breadth, but is always of large size, and is lodged between two laminæ of the dura mater, in a superficial depression of the bone. In its interior, it presents a very distinct cavernous tissue. It receives several veins from the labyrinth.

It is by no means rare to see two or three other transverse sinuses placed between the latter and the occipital hole.

OF THE PIA MATER.

1513. The *Pia Mater, (Meninx Interior,* Soemm.) like the dura mater, covers the brain on all sides, and like the arachnoid membrane, is prolonged into its internal cavities; but it also belongs to the anfractuosities and depressions which are observed at its surface. It is not prolonged over the spinal marrow. We also observe that, properly speaking, it is not a true membrane analogous to the organs that are known under that name. It is a cellular, loose, transparent web, without consistence, in which there ramify and cross each other in a thousand different directions a multitude of blood vessels, more or less delicate, and more or less tortuous, and which is only attached to the surface of the brain by the ramuscules of these vessels which penetrate into the substance of the latter organ.

1514. *External Pia Mater.* Above, the pia mater, covers on each side, the convex surface of the two hemispheres of the brain, sinks into their anfractuosities, is reflected in the great longitudinal fissure, prolongs itself over the upper surface of the corpus callosum, and descends upon its anterior extremity. At the level of the posterior extremity, it also bends downwards, but it enters into the middle ventricle. Inferiorly, the pia mater covers on each side the anterior, middle, and posterior lobes of the brain, sinks into the fissura Sylvii, is reflected over the commissure of the optic nerves, after lining the kind of membrane which closes the third ventricle anteriorly, passes over the layer of gray substance which forms its floor, envelopes the pituitary shaft, invests the inferior surface of the cerebral protuberance, is engaged in the groove which separates it from the spinal marrow, on which it presently ceases in an insensible manner, to be carried over the lower surface of the cerebellum, and from thence over the upper, as far as the posterior cerebral fissure, by which it enters into the third ventricle. It sinks between the lobes of the cerebellum, and is engaged in all the anfractuosities which separate its concentric laminæ.

By its *outer surface*, the pia mater is in contact with and adheres to the arachnoid membrane, upon all the cerebral prominences; but it is entirely isolated from it opposite the depressions into which it penetrates by itself. They are then even frequently separated by a pretty large vacant interval, as may be easily seen in the fissura Sylvii, in the spaces which exist between the lobes of the cerebellum, between the brain and the cerebral protuberance, &c. Its *inner surface* corresponds everywhere to the cerebral substances.

1515. *Internal Pia Mater*. The pia mater penetrates into the middle ventricle by the transverse fissure which exists between the corpus callosum and the cerebral protuberance, and into the lateral ventricles by that which is met with on each side between the optic thalamus and the fimbriated body.

1516. In penetrating by the transverse cerebral fissure, the pia mater forms, in the third ventricle, the *Choroid Web*, a kind of membranous prolongation which lines the posterior part of the corpus callosum and the inferior surface of the fornix, to which it adheres by a great quanity of vascular twigs. Its form is that of a truncated triangle, whose base, which is very broad, is directed backwards. Its lower surface is free anteriorly in the middle ventricle, and, farther back, presents the orifice of the arachnoid canal, above the pineal gland, which is embraced in the folds of the choroid web. The latter, altogether posteriorly, is applied upon the posterior commissure and the tubercula quadrigemina. Laterally, it covers the upper region of the thalami of the optic nerves, passes into the fissures which separate them from the fornix, and is continuous with the edge of the choroid plexus. Anteriorly it is continuous with these same plexus by the apertures of communication of the lateral and middle ventricles.

1517. The *Chloroid Plexus* are a kind of flat, reddish membranovascular cords, attached to the choroid web by one of their edges, loose, floating and undulated at the other edge, and extending, in the lateral ventricles, along the sides of the fornix and fimbriated bodies. They are more voluminous in the lower part than in the upper part of the ventricles, and altogether inferiorly and posteriorly, they communicate directly with the external pia mater, which dives into the brain between the thalami of the optic nerves and the fimbriated bodies. They are especially formed by folds of the pia mater, in which there ramify a multitude of minute arteries and especially veins. There is frequently perceived in them a more or less considerable number of small rounded bodies, of the size of a millet seed, or even smaller. Many anatomists have considered them as glands; but, Chaussier asserts that they are membranous fringes, which may be unfolded by agitating them in water. There are also frequently found in them small serous cysts or vesicles.

OF THE ARACHNOID MEMBRANE.

1518. The *Arachnoid* Membrane (Meninx media,* Soemm.) is situated between the dura mater and pia mater, and was long confounded with the latter. It belongs to the class of serous membranes. It is extremely thin, transparent, polished, and constantly moistened with a serous fluid. It scarcely contains any blood-vessels. It represents a kind of bag without aperture, covering the whole surface of the brain, and the walls of the cavity which the dura mater forms. It furnishes all the nerves, and all the vessels which enter or issue from the skull and vertebral canal, with a sheath or envelop which accompanies them, and is reflected over them, so that none of these organs is contained in its cavity, which is only filled with a serous vapour. Its thickness is a little greater in the places where it is free, at its two surfaces, and in the sheaths of which we have just spoken.

1519. *External Arachnoid Membrane.*—On the convexity of the cerebrum, it invests the circumvolutions without penetrating into the anfractuosities by which they are separated, and gives to each vein a sheath which is reflected over the dura mater. Descending on each side in the great longitudinal fissure, it lines the corpus callosum, passing over the arteries which cover it, and furnishes the veins of the inferior longitudinal sinus with envelopes which are afterwards continued into the falx cerebri. Posteriorly, the arachnoid membrane is prolonged over the posterior lobes, envelopes some of the veins of the lateral sinuses, is reflected over the upper surface of the cerebellum, surrounds the veins of the straight sinus, and part of those of the lateral sinuses, then covers the circumference and inferior surface of the cerebellum, between the two hemispheres of which it is isolated by its two surfaces over a greater or less extent.

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* Ἀραχνοειδὴς, resembling a spider's web.

Anteriorly, the arachnoid membrane descends over the anterior lobes, and passes immediately from the one to the other inferiorly, near the commissure of the optic nerves, without penetrating into the fissure which separates them. It equally covers the inferior surface of the olfactory nerves, for which it forms a small sheath near their extremity. It also furnishes one to each of the optic nerves; but this sheath is conical, accompanies them to a great distance, and is only reflected upon their fibrous envelope in the orbit. It descends farther around the pituitary shaft, and is expanded over the pituitary body which separates it from the dura mater. It embraces the internal carotid artery at its exit from the cavernous sinuses. It then passes under the cerebral protuberance, being separated from the pia mater in all the space that exists between that protuberance and the commissure of the optic nerves, which is also separated from it, but by a less marked interval, at the level of the protuberance and the grooves which limit the anterior prolongations laterally. It also gives sheaths to the common motor nerves of the eye, the pathetic, trifacial, external motor, facial and acoustic nerves. Lastly, it directs itself over the lateral parts of the cerebellum, the posterior prolongations, the pneumogastric, spinal, accessory, hypoglossal, and suboccipital nerves, the vertebral arteries, and the spinal marrow itself, with which it is only connected by a small number of cellular filaments, easily torn, and which in general scarcely exist, so that it may be very easily detached by insufflation. On the sides of the spinal marrow, the arachnoid membrane furnishes to each nerve a conical envelope, which is reflected upon the dura mater at the moment when the nerve penetrates it. It also furnishes an envelope to the vessels which creep upon its anterior and posterior surfaces.

Lastly, on arriving at the lower extremity of the spinal marrow, it terminates by a sort of narrow and very long canal, of a cylindrical form, which descends vertically in the middle of the bundles of the lumbar nerves, to the extremity of the sacral canal, where it is reflected upon the dura mater.

It is by means of this canal, and of all the envelopes of the nerves and vessels, that it may be conceived how the arachnoid membrane covers in its whole extent the inner surface of the dura mater, and gives it the smooth and polished appearance which it presents. It is pretty difficult to separate these two membranes from each other by the scalpel, excepting in the fœtus or in very young children.

1520. *Internal Arachnoid Membrane.* In proceeding from the corpus callosum over the cerebellum, the arachnoid membrane, which has here become extremely thin, dives into the middle ventricle by an oval aperture which Bichat first discovered. This aperture is the orifice of a canal formed in the portion of the pia mater which goes to constitute the tela choroidea (1516), and which embraces on all sides the venæ Galeni and their numerous roots, to which the arachnoid membrane furnishes an envelope. This canal is afterwards prolonged under these veins, between the pineal gland and the tubercula quadrigemina, and opens into the third ventricle, beneath the choroid web, between the masses of granulations of the pineal gland (1476.) It is from thence that the arachnoid membrane proceeds to line the walls of the third ventricle, and the lower surface of the choroid web. It then passes, by means of the communicating apertures, into the lateral ventricles, where it covers the choroid plexus, closing the fissure which exists between the fornix, the corpora fimbriata, and the optic thalami. Lastly, by the aqueduct of Sylvius (1480) it descends into the ventricle of the cerebellum of which it closes all the apertures.

1521. Red vessels have not yet been observed in this membrane, even when it is inflamed. Mascagni and Ludwig assert their having seen lymphatic vessels in it, but no nerves have been discovered.

10. GRANULATIONS OF THE ENCEPHALIC MEMBRANES.

1522. There are observed, in various parts of the extent of the dura mater and pia mater, certain small bodies of a whitish or yellowish colour, sometimes isolated, sometimes collected together in the form of a bunch of grapes, which receive vessels, but are destitute of nerves, of whose intimate texture and uses we are entirely ignorant, and which are not met with in children or in all subjects.

The superior longitudinal sinus contains a remarkable quantity of them, particularly at its middle and posterior parts. They were formerly designated by the name of *Glands of Pacchioni,* although they are very different from glandular organs. These granulations generally occupy in this sinus the circumference of the orifices of the veins, where they form a more or less distinct prominence between the internal bridles. Very few of them are isolated, almost all being agglomerated into small masses, and intimately connected with each other. They are covered by the internal membrane of the sinus.

In the torcular Herophili very few of them are observed. But there are some at the mouths of the veins, in the occipital portion of the lateral sinuses. In the straight sinuses some are occasionally found at the orifices of the venæ Galeni. All the other sinuses are destitute of them.

1523. In the external pia mater graniform bodies resembling those of the sinuses are also met with. They are especially observed along and to the outside of the superior longitudinal sinus, around the cerebral veins. Here they are enveloped by the arachnoid membrane, and their size is so much the larger the nearer they are to the sinus. Some of them are engaged in the separations of the fibres of the dura mater which give passage to the veins, and are in some measure continuous with the granulations of the sinus itself. At the base of the brain and around the other sinuses no similar disposition is observed.

1524. The internal pia mater also presents some of these granulations. They are observed in the choroid plexus, where they are of a reddish gray colour, and rather soft. There are also some beneath the choroid web, at the fore part of the pineal gland, where they are disposed in two rows which unite so as to form a triangle, at the base of which the canal of the arachnoid membrane opens. Lastly, they are equally met with in the choroid plexus of the fourth ventricle.

11. OF THE PROPER MEMBRANE OF THE SPINAL MARROW.

1525. Some authors consider this membrane as a prolongation of the pia mater of the brain; but it presents sufficient differences to render it distinguishable from that envelope. It is formed by a solid, pretty thick, firm, strong, and somewhat fibrous tissue. Its density is so much the greater the lower it is examined. Few vessels ramify upon it, but it is traversed by a great number on their way to the spinal marrow. Its colour is yellowish white. By its *external surface*, it is in connection with the arachnoid membrane, but forms no adhesion to it. Laterally, it is continuous with the neurilemma of the vertebral nerves and with the ligamentum dentatum. Its *internal surface* adheres to the spinal marrow in so intimate a manner as to seem to be continuous with it. Its *upper extremity* is prolonged, becoming insensibly thinner, as far as the cerebral protuberance.

12. OF THE LIGAMENTUM DENTATUM.

1526. The *Ligamentum dentatum* is a whitish, transparent, thin, but very strong band, which extends from the great occipital hole to the inferior extremity of the spinal marrow, passing on each side between the anterior and the posterior roots of the vertebral nerves. Several modern anatomists have considered the ligamentum dentatum as a prolongation of the proper membrane of the spinal marrow; but it is really distinct from it.

In its *outer edge*, each ligamentum dentatum presents successively twenty or twenty-two denticulations, from which the ligament has received its name, and whose points, which are more or less oblong, are attached to the sheath which the dura mater forms around the spinal marrow, in the interval that occurs between each pair of cervical and dorsal nerves. The base of each of these denticulations is triangular; but their form and size vary much. The upper are shorter and transverse; the lower become gradually more oblique and longer. The first is attached, by a very sharp filament, to the edge of the great occipital hole, between the hypoglossal nerve and the vertebral artery. The last is fixed to the upper part of the twelfth dorsal, or first lumbar vertebra, and separates the dorsal from the lumbar nerves.

By its *inner edge*, this ligament adheres to the proper membrane of the spinal marrow, by means of a dense cellular tissue, without any continuity of substance taking place.

1527. It must not be confounded with the arachnoid membrane which covers it, and from which it may be separated by insufflation. Its intimate structure is entirely unknown. Its use appears to be to keep down the spinal marrow in its canal.

II. *Of the Encephalic Nerves, or Conducting Organs of the Sensations and Volitions.*

GENERAL CONSIDERATIONS.

1528. The *Encephalic Nerves* are white, generally cylindrical cords, commonly communicating with each other in various parts of their course, arising, symmetrically and in pairs, from the brain and spinal marrow, and formed of a more or less considerable number of interlaced filaments connected together by cellular tissue.

They vary in their direction, being parallel, perpendicular, or inclined to the axis of the body; but, whatever this direction may be, they almost always proceed in a direct line, in place of being tortuous like most of the arteries. As they recede from the place of their origin, the nerves divide into branches and twigs which terminate by filaments, which again subdivide into very delicate fibrils. The separation of the branches and twigs takes place at angles more or less acute with relation to the trunk, and is indicated long before by a groove which results from a mere juxta-position of the branch against the trunk, a circumstance which is not observed in the divisions of the vessels.

In general, the nervous trunks traverse the great cellular interstices of the trunk and extremities. Most commonly they are cylindrical; but sometimes also they are flat, as is observed in the sciatic nerve. Their length varies much; but it is greater in the extremities than in the trunk or upon the head. They may be isolated on their passage, or accompanied by blood-vessels.

It is also to be remarked that the sum of the united diameters of the different branches of the same nerve is much greater than the diameter of its principle trunk, so that every nerve may be said to represent a cone whose base is at the periphery of the body or organs, and the summit at the brain or spinal marrow.

1529. The filaments which terminate the branches of the nerves end by being continued into other nervous filaments, or lose themselves in the tissue of the organs, without our being as yet able to say exactly in what manner. The communication of the nervous filaments, or their continuation into each other, is named *Anastomosis;** and this mode of junction must be carefully distinguished from that of mere juxta-position, which is sometimes observed.—The nervous anastomoses may take place in four different ways: 1st, By two branches which belong to different nerves, as is observed to take place between the hypoglossal nerve and the cervical nerves. 2dly, By branches of the same nerve, as in those of the trifacial nerve or facial nerve. 3dly, By branches united in the median line of the body, and coming separately from each side, as may be seen in the superficial nerves of the neck and face.—These three modes of anastomosis take place between filaments of the same nervous system. But, 4thly, There is another in which filaments of the encephalic system are united with filaments of the system of the ganglions.

1530. If two or more different nerves approach each other, if their different branches are confounded by a great number of anastamoses, or even of juxta-positions, so that there results a sort of more or less complicated net-work with meshes more or less lax, the name of *Plexus* is given to this interlacement. The different nervous branches which are spread out to form a plexus unite again, and give rise to trunks which pursue their course in the usual manner. Very distinct examples of this arrangement occur in the extremities.

1531. Every encephalic nerve is formed by a greater or less number of cords, placed in juxta-position, which are themselves formed of several filaments of the same nature. The number of these filaments is always very considerable, and frequently even cannot be determined by optical instruments; but, with the assistance of acids and alkalies, the structure of the nerves, such as we shall presently describe it, is as it were laid bare. All these cords also, as well as their fibres, are connected by cellular tissue. On separating them, it is perceived that they send frequent branches to each other, so as to form a kind of plexus in the very substance of the nerve, on which account, the filaments that compose the cords are after a certain passage no longer the same as at the commencement of the nerve.

The disposition of the nervous cords presents numerous variations. Their size is seldom the same in the different nerves; nor is it proportional to the volume of the nerve. Those of the sciatic nerve are smaller, for example, than those of the radial or ulnar nerves. Sometimes also a nerve is only formed of a single cord, divided by a great number of grooves: such is the pneumo-gastric nerve. The same nerve sometimes unite large and small cords; at other times they are equal, as in the sciatic nerve, &c.

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* 'Αναστόμωσις, *Inosculatio.*

1532. Every encephalic nerve is enveloped by an external membrane, which forms for each of its filaments a true canal in which is contained a white medullary matter. This membrane is the *Neurilemma.** That which surrounds the vertebral nerves is manifestly continuous with the proper membrane of the spinal marrow (1525;) and, in like manner, that which envelopes the nerves at the level of the cerebral protuberance appears to be identified with the pia mater, which invests that portion of the brain.

The olfactory nerve has no neurilemma, and the optic nerve presents it only after its commissure.

The neurilemma adheres strongly to the cellular tissue. It is transparent, and seems fibrous. It is very easily hardened under the action of acids or caloric; by long-continued boiling it acquires a peculiar yellowish tint; alkalies have no effect upon it; maceration does not dissolve it, and it resists putrefaction for a very long time. Its tenacity is considerable; but its intimate nature is yet very little known.

1533. In each tube formed by the neurilemma is a medullary substance† which exactly fills it. It seems of the same nature as the white substance of the brain and spinal marrow. It is from it that the nerve derives its peculiar tint. By desiccation it becomes sensibly yellow. It resists putrefaction more than the encephalic tissue. Like it it does not harden either under the influence of caloric, or under that of acids. Like it, also, it remains suspended in water under the form of an emulsion. By ebullition, it acquires a dull and gray hue. Sulphuric acid at first hardens it, and then reduces it to a pulp; nitric acid only renders it yellow and hardens it; alcohol also hardens it, while the alkalies dissolve it.

We have to remark, however, that many anatomists, even of the present day, do not admit this intimate structure of the nerves, and refuse to the neurilemma the canaliculate form which we have attributed to it above; but when these organs are submitted to the action of different reagents, as they have been by Reil and Bichat, the circumstances mentioned above are met with.

1534. The nerves are invested and connected with the neighbouring parts, by an abundant layer of adipose cellular tissue, which sends off internally prolongations which separate and isolate the nervous cords and filaments from each other. The principal of these prolongations generally contain fat; but those which are interposed between the nervous filaments themselves do not contain any. This cellular tissue unites the cords of the nerves and their filaments, so that no motion can take place between them. It is not observed around the nerves that are lodged in a bony canal.

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* Νεῦρον, *nervus*; Λεμμα, *tunica*.

† Some authors, and among the rest Monro, are of opinion that a gray substance also exists in the nerves.

1535. The arterial trunks which accompany the nerve, send them branches which penetrate on all sides into their interior. The optic nerve is the only exception to this rule. These small arteries creep at first in the cellular tissue that exists between the cords, and have there a more or less considerable size. They send small branches into all the interstices of the filaments, which expand upon the neurilemma and seem to lose themselves upon its inner surface.

1536. The veins of the nerves follow the same course as their arteries, but they do not issue by the same places which give entrance to the latter.

1537. Absorbent vessels have not yet been traced in all the nerves, some authors having only pointed them out in the principal nerves; nor has it been demonstrated that nervous filaments go to be distributed upon the neurilemma.

1538. The encephalic nerves are usually divided into several classes, according to the place where their trunk connects itself with the encephalon, and they are thus distinguished into nerves which arise from the cerebrum, the cerebral protuberance, the medulla oblongta, and the medulla spinalis. The cerebellum does not furnish any. But recent discoveries, of which indications, however, were previously furnished by various anatomists, afford quite different ideas with respect to the nerves. Like the different parts of the encephalon, they seem produced, at their origin, by bundles of fibres reinforced by gray matter. It even appears demonstrated that in following the roots of the different nerves, they are seen ascending from the spinal marrow towards the point where they show themselves externally; and, in fact, the olfactory nerve is the only one in which no direct connection with the spinal marrow can be demonstrated, or at least with the protuberance formed especially by the medullary cords which arise from its upper part. In several nerves, however, in man, this disposition is not so manifest as not to require the analogy furnished by the anatomy of animals of the other classes; but as we are merely occupied with the description of the organization of the human body, we must stop short where the testimony of the senses can no longer guide us in our researches. We shall, therefore, confine ourselves to the circumstances that are manifested in man.

OF THE ENCEPHALIC NERVES IN PARTICULAR.

OF THE OLFACTORY NERVES, OR FIRST PAIR OF NERVES.

1539. There are few subjects in anatomy that present so much diversity of opinion in authors as the olfactory nerves, whether with reference to their origin, or to their texture, and even their use. The ancients considered them as a kind of emunctories, or canals by which the serum and pituita separated by the brain flowed off, and named them *Processus Mammilares*. They formed the subject of a long series of discussions, and it is only by the labours of the more recent anatomists that we have been apprised of their true structure and precise distribution.

1540. The origin of the olfactory nerves takes place by three filaments which are named their roots, and which have been followed beyond the surface of the brain, and far into the substance of that organ. Two of these roots are formed by the white substance, and are distinguished into outer and inner; the third is gray.

1541. The *outer white root*, which is the longest, is directed outwards, backwards, and upwards, concealed in a great measure by the fissura Sylvii, and placed above the contorted branches of the internal carotid artery. It arises from the outer region of the corpus striatum (1464,) and becomes apparent externally at the most remote part of the anterior lobe of the brain, in its point of union with the middle lobe, upon the gray substance of its last circumvolution, in the midst of very distinct apertures which give passage to as many large vascular trunks that penetrate into the brain. It also frequently receives in this region one or two small medullary filaments which make it appear palmated.

1542. The *inner white root*, which is shorter and broader, presents a silvery colour, like the preceding. It appears to be confounded posteriorly and internally with the white substance which occupies the inner part of the fissura Sylvii, and is prolonged as far as the anterior part of the corpus callosum, being sometimes bifurcated; but, like the other, it always seems incrusted in the gray substance, and appears only traced upon the inferior surface of the brain.

1543. Frequently the mode of origin of these two roots is not the same to the right and left; frequently also, in the angle which results from their union, there are observed some white filaments which join them, and which proceed from the nearest cerebral circumvolution. Sometimes, one or other of them divides, in the middle of its course, into two branches which soon unite, so as to circumscribe a kind of island of gray substance.

1544. The *gray root* has the form of a pyramidal body laid over the point of junction of the preceding two, and united to them by its summit, which is directed forwards. After this junction, it becomes a thin cord, always retaining its grayish colour, which prevails upon the middle of the upper surface of the nerve. On slitting it in the direction of its length, its centre is found occupied by white substance, and at the distance of three or four lines beyond its union, the gray matter is gradually seen to become thinner and at length to disappear altogether, so as to leave this central medullary part exposed.

1545. There is observed between the three roots of the olfactory nerve a portion of the white substance of the brain, entirely laid bare at the inferior surface of the cerebrum, and perforated with a great number of more or less vertical holes for the passage of small arteries, so that these roots are in a manner surrounded and penetrated by vessels.

1546. At the place of their union, the nerve presents a triangular bulging. It becomes presently flattened, contracts, and directs itself horizontally forwards under the anterior lobe of the brain, situated in a groove which is especially destined for it, which conceals its gray portion, and prevents its from projecting below, and from being compressed upon the bones of the base of the skull. This groove, which we have already described (1436,) is always prolonged farther forwards than the extremity of the nerve, and is much deeper at its middle part than at its two extremities. The inferior surface of this latter part, which presents seven longitudinal striæ, of which three are cineritious and four white, is covered by the arachnoid membrane. It is manifestly flattened, while the upper surface presents a prominent ridge which penetrates into the groove; a disposition which makes the nerve appear as if inclosed in a canal of which the upper part is formed by this groove of the brain, and the lower by the arachnoid membrane.

As it advances, the olfactory nerve proceeds a little inwards, so as to approach its fellow, and to be only separated from it by the crista galli. Its prismatic form also changes insensibly, so that it does not present an equally triangular section in all its extent. It rests posteriorly upon the upper surface of the body of the sphenoid bone, and anteriorly upon the ethmoid groove, where it becomes larger, and even forms a prominence which it receives, and which is a kind of bulb or olivary ganglion, more rounded before than behind, which contains much gray substance, but resembles the other nervous ganglia only in colour.

During this course, the olfactory nerve, which is sometimes larger on the right side, and sometimes on the left, is soft and pulpy, and is not enveloped by a neurilemma. Many authors have alleged that it is hollowed by a canal in its whole extent; but the most careful examinations have failed to enable me to perceive it, nor have the most celebrated anatomists of our days been more successful.

1547. It is from the inferior surface of the bulb which fills the ethmoid groove, that the branches proceed which are to be distributed in the nasal fossæ and which pass through the apertures of the cribriform plate. They vary much in their number, form, and direction. Frequently the largest holes receive two or three; but they may always be distinguished into external, internal, and middle.

1548. Their number differs much in different subjects. Sometimes they are very small and very numerous, while at other times there are very few of them, and they are much larger. Each of them is embraced by a small funnel-shaped fibrous canal furnished by the dura mater, which stops short a little beyond the hole, and is continued into the outer layer of the pituitary membrane. They are also enveloped by the arachnoid membrane, which adheres loosely to them, and which leaves them after a short passage to be reflected upon the fibrous canal and enter the skull, forming a kind of cul-de-sac. A gray, transparent lamina, and the pia mater, which descends to a greater or less distance in the nassal fossæ, also accompany them.

1549. The moment they are enveloped by the dura mater, the branches of the olfactory nerve become thicker, and harden to such a degree as no longer to resemble what they were at first.

1550. The *external branches* are prolonged into the canals which are observed upon the turbinated bones; they divide and subdivide, anastomosing with each other, without leaving these canals, which themselves anastomose. When they have emerged from them, their anastomoses become still more frequent, and they form a true plexus which may be distinctly perceived on dissecting under water. On the upper turbinated bone there are observed several, which curve backwards, so that their convexity is turned towards the sinus of the sphenoid bone. Those of the anterior part, which are more numerous, are nearly vertical. The middle ones are the longest of all. They curve backwards upon the ethmoidal turbinated bone and there ramify much, but without passing to the concave surface, the membrane of the ethmoid cells, that of the sinuses, or the inferior turbinated bone.

1551. The *internal branches*, already divided before leaving the cribriform plate, follow the septum, on which they divide anew into a great number of filaments between the two layers of the pituitary membrane. Their number is at first from twelve to fourteen, each of them subdivides to such a degree as to appear penicilliform, and to be the origin of a very compound bundle. Several of these filaments joined together form whitish bands of various length, of which one or two reach nearly as far as the bottom of the septum. Anteriorly, they do not extend beyond its middle; posteriorly, they are much shorter still, and are curved back upon the convexity of the sphenoidal sinuses.

1552. The *middle branches*, on arriving in the nasal fossæ, almost immediately lose themselves in the portion of the membrane which lines their vault.

1553. There is much diversity of opinion about the manner in which these branches terminate. Many anatomists have thought that they formed the villosities or papillæ of the pituitary membrane. The most careful dissections, aided by various reagents, have not afforded me any information on this subject. Scarpa has been equally baffled with the microscope. He merely saw them forming a kind of proper membrane, in which, according to Blumenbach's remark, they seem in a manner to be dissolved.

1554. In their trunk, the olfactory nerves receive arteries which arise from the anterior arteries of the corpus callosum, and which are expanded in the pia mater which covers its inner surface. They are very numerous, and follow the nervous filaments as far as the nose, where they sometimes appear through the pituitary membrane. Small veins are also observed around their trunk, as well as some lymphatics.

1555. The olfactory nerves differ from all the other nerves in the following circumstances:

Their trunk has three roots, which the two substances of the brain concur to form.

It converges towards that of the opposite side as it advances.

Its form is that of a triangular prism.

It is lodged in a particular groove of the brain.

The arachnoid membrane does not furnish it with a sheath, and only covers it on one of its surfaces.

It is entirely soft and pulpy.

It has no neurilemma.

Its filaments do not anastomose with those of any other nerve.

They issue from the skull by a great number of holes.

OF THE OPTIC NERVES, OR SECOND PAIR OF NERVES.

1556. More voluminous than the preceding, and than all the other nerves which issue from the head, with the exception of the trifacial, and remarkable for the circumstance of their course being longer within than externally of the head, and for their not furnishing a single branch from their origin to their termination, the optic nerves do not come from the thalami of that name, as they are pretty generally described as doing, but evidently appear to issue from the tubercula quadrigemina. In fact, the anterior pair of these tubercles (the *nates*) furnish a white fibrous band, which turns over the outer edge of the optic thalami, and is reinforced by joining itself intimately to the *corpus geniculatum externum*, (1463,) a kind of bulging formed of cineritious matter. Thus far the band adheres by the whole of one of its surfaces to the optic thalamus; but it now passes under the peduncle of the brain, to which it is here only attached by its outer and anterior edge. The posterior pair of the tubercula quadrigemina (the *testes*) also furnish a similar band, which passes under the *corpus geniculatum internum*, but cannot be followed farther, so that it is impossible to decide whether it really belongs to the optic nerves.

1557. Immediately after their origin, the optic nerves proceed forwards and inwards, leaving the fissure which separates the middle lobes from the cerebral protuberance, and in which they were at first concealed. When they have arrived beyond the peduncles of the brain, they cease to be broad and flat; they contract and become rounded, are exposed under the floor of the third ventricle, and adhere to the layer of gray substance (the *tuber cinereum*) which chiefly forms it. This layer sends to the upper surface of the nerve several white filaments, which do not cross each other, but are united to each of its sides, following a straight line.

1558. At the fore part of the pituitary fossa, the two optic nerves are so near each other that they unite and are confounded, without its being possible, however, to affirm in a positive manner whether they cross each other, so that the left nerve passes to the right, and the right to the left, or whether the substance is mingled and identified in this place, which appears more probable; but comparative anatomy and pathological affections furnish nearly as many facts for the one as for the other of these opinions. At the place of this union, the optic nerves form a quadrilateral body, which rests upon a transverse groove of the sphenoid bone, gives attachment by its upper surface to the membrane which closes anteriorly the third ventricle, and is manifestly continuous behind with the *tuber cinereum*, whence the pituitary shaft arises.

1559. The optic nerves then separate again; but they are now perfectly cylindrical and isolated on all sides. They direct themselves forwards and outwards toward the optic foramen, through which they issue from the skull, along with the ophthalmic artery, which is placed at the lower and outer part. In this second part of their course, they begin with being enveloped by a neurilemma, while from the moment when they issue from beneath the middle lobe of the brain until that of their union, they were only covered by the pia mater and arachnoid membrane, and at the under surface only.

1560. The latter membrane, however, at the foremost part, forms around them a sheath which accompanies them into the optic foramen, and is then reflected over the dura mater, which also furnishes them with a fibrous canal, which we have already described (1489). In passing through the optic holes, they bend slightly at an obtuse angle, and become of smaller diameter. At their entrance into the orbit, they are surrounded by the posterior extremities of the four recti muscles of the eye, from the fleshy bodies of which they are separated by a considerable mass of adipose cellular tissue, in which are found immersed the ciliary nerves and vessels, and the ophthalmic ganglion. During their passage in this cavity, the optic nerves describe a slight curvature, of which the convexity is directed outwards. On arriving at the posterior, internal, and inferior parts of the eye, they experience a manifest contraction, traverse the sclerotic and choroid membranes, and terminate at the middle of the retina by a truncated extremity.

1561. Until the moment of their union, the optic nerves are soft and entirely pulpy; they present at their surface no trace of striæ or cineritious substance; they only pretty generally present some apertures which are traversed by blood-vessels. Beyond their commissure, they become denser and firmer. From the optic hole to their termination, they are surrounded by an exterior neurilemma, very distinct from the meningeal sheath, with which they are, however, connected by small somewhat laminar prolongations. This neurilemma is thicker, stronger, and whiter than that of the other nerves. From its internal surface there are detached prolongations in the form of partitions, which seem to divide the interior of the nerve into a great number of small canals filled with white substance, and give it the appearance of one of those Indian canes or *rattans* used for walking sticks. The optic nerve is not, therefore, like the other nerves, formed of an assemblage of filaments united into a cord, and its structure may be very well seen by leaving it to macerate for some time in a solution of deuto-hydrochlorate of mercury, and by washing with a solution of deutoxide of potassium the parenchyma which is obtained by this means, and which must be quickly dried after the two ends have been tied with a thread.

By means of the microscope, M. Bauer has lately, (September 1820), found that the fibres whose assemblage constitutes the optic nerve are composed in a great measure of very minute globules whose diameter varies from $\frac{1}{2800}$ to $\frac{1}{4000}$ of an inch. These globules resemble those of the blood deprived of their envelope of colouring matter, and are united together by a gelatinous substance very soluble in water and perfectly transparent.

1562. Besides these peculiarities of structure, the optic nerve is further distinguished from all others, by the circumstances, that it is enveloped by the dura mater to the place of its termination, that it unites with its fellow, and that a little before terminating it presents a contraction.

OF THE COMMON MOTOR NERVES OF THE EYE, OR THIRD PAIR OF NERVES.

1563. Intermediate in size between the optic and pathetic nerves, and generally equalling the acoustic, these nerves *issue*[*] from the peduncles of the brain, towards their inner edge, and receive filaments from the perforated cineritious space included between the two peduncles and the mammillary tubercles. At the moment when they appear, the filaments of the motor nerve of the eye are very soft, and break with the greatest ease. It may, however, with proper care, be discovered that they are arranged in a line which follows nearly the direction of the peduncles; that the posterior are the longest, and that most of them may be followed under the cerebral protuberance, and as far as the central black spot of the peduncles.

1564. At the moment of their union, these filaments form a flat cord, which is closely embraced by the posterior cerebral and superior cerebellar arteries. Presently this cord contracts and becomes rounded, acquires more consistence, and is enveloped by a neurilemma and by the arachnoid membrane. Free at the under part of the brain, it proceeds obliquely forwards and outwards to the level of the point which the tentorium cerebelli forms anteriorly. There, it is lodged in a canal formed in the outer wall of the cavernous sinus of the dura mater (1491,) at the entrance of which it is left by the arachnoid membrane, which forms a cul-de-sac. It thus arrives at the sphenoidal fissure, being only separated from the internal carotid artery by a thin lamina of cellular tissue. In this part of its course, that is to say, from its entrance under the dura mater, the common motor nerve of the eye is situated internally of and above the pathetic nerve and the ophthalmic branch of the trifacial nerve; but under the anterior clinoid process, it is in its turn covered by these two nerves, which cross it obliquely, and which become internal with respect to it.

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[*] It is to be observed that we employ this and similar expressions for the purpose of accommodating ourselves to the language generally adopted, for it now appears demonstrated that the nerves isolated from the spinal marrow and brain, are, on the contrary, in consequence of a concentric march, *inserted* into the tissue of these latter parts.

1565. A little before passing through the sphenoidal fissure, it divides into two branches, a superior and an inferior, which traverse the dura mater, and penetrate into the orbit by the broadest part of that fissure, passing between the two portions of the posterior extremity of the rectus externus oculi, along with the external motor nerve of the eye and the nasal branch of the ophthalmic nerve, to which they are united by cellular tissue.

1566. *Superior Branch.* It directs itself forwards and a little inwards, passes above the optic nerve and the nasal branch, immediately proceeds to the inferior surface of the rectus superior oculi, and furnishes it with a great number of divergent filaments. Another filament, a little smaller, follows the inner edge of this muscle, or even traverses it to be spread out in the levator palpebræ superioris. This branch also receives one or two small twigs of the nasal nerve.

1567. *Inferior Branch.* Much larger than the preceding, it advances between the lower and outer part of the optic nerve and the rectus inferior oculi, and, after a short passage of a few lines, divides into three twigs: 1st, an *inner*, which is the largest, and proceeds obliquely to the origin of the rectus internus oculi, in the substance of which it is expanded; 2dly, a *middle* twig, much shorter and smaller, which proceeds directly forwards, and ramifies in the rectus inferior; 3dly, an *outer*, much longer and more slender than the other two, which, at its origin, gives off a short and flat filament, ascending externally of the optic nerve, and going to be united to the posterior part of the ophthalmic ganglion, and which then proceeds between the rectus inferior and rectus externus, without furnishing them with any filament, passes under the ball of the eye, and at length penetrates nearly at a right angle into the obliquus inferior, near its tendon.

1568. This nerve, which has nothing peculiar in its structure, gives motion to all the muscles of the eye, excepting the rectus externus and obliquus superior. It communicates with the ophthalmic ganglion.

OF THE PATHETIC NERVES, OR NERVES OF THE FOURTH PAIR.

1569. These nerves, which are the most slender of all those furnished by the brain, have a considerable course within the skull, and only give off branches at the moment of their termination. Their origin is perceived, sometimes higher sometimes lower, behind the posterior pair of the tubercula quadrigemina (the testes), on the lateral parts of the valvula Vieusenii (1443.) The number of their roots varies from one to four, and is not always the same on both sides. Sometimes the roots of one of the nerves are united to those of the opposite nerve by a transverse band; sometimes they are not even on the same level. They are soft and destitute of neurilemma, and break with the greatest facility.

1570. They unite almost immediately into a single, very thin, rounded, strong cord, which descends outwards and forwards, turns over the peduncles of the brain, between the cerebrum and cerebellum, passes above the arachnoid membrane and along the small circumference of the tentorium cerebelli, and arrives at the posterior clinoid process. There it enters a canal with which the dura mater furnishes it (1491), is abandoned by the arachnoid membrane, which is reflected over the latter, and is separated internally from the cavernous sinus by the thin cellular lamina which also separates the preceding from it. From being at first horizontal and placed beneath the latter and above the ophthalmic branch, it changes its direction near the sphenoidal fissure, and ascends obliquely above the common motor nerve of the eye along with the ophthalmic branch, to the inner side of which it proceeds. It then penetrates into the orbit through the widest part of the sphenoidal fissure, passing through the dura mater. On arriving in the orbit it proceeds forwards, along with the frontal twig of the ophthalmic nerve, above the rectus oculi superior and levator palpebræ superioris, and beneath the periosteum. Lastly, it directs itself inwards, passes into the middle part of the obliquus oculi superior, after sensibly increasing in size, and terminates entirely in it, dividing into several filaments.

OF THE TRIFACIAL NERVES, OR NERVES OF THE FIFTH PAIR.

1571. The first origin of these nerves occurs at the upper extremity of the spinal marrow, between the corpora olivaria and restiform body. It is a bundle of white fibres which ascends outwards in the substance of the cerebral protuberance, above the posterior part of the pons Varolii (1442,) receives in this course a considerable number of new white fibres, is thus increased in size, and, seems henceforth divided into three branches. Arrived at the outer and lower part of the peduncles of the cerebellum, near the outer edge of the protuberance, it becomes free, leaves the encephalon, and forms a very large flat cord, composed of a very great number of distinct and parallel filaments, enveloped each with a neurilemma which gives them more solidity and density.

1572. On examining all these small nervous filaments with great care, it is seen that those which occupy the centre of the cord receive the neurilemma later than those which are situated at the circumference. There results from this that they must break at unequal distances, and this is the reason why on detaching the trunk of the trifacial nerve from the place where it becomes free, there occurs on the surface of the brain, at the very point which it occupied, a sort of whitish mammilla, which seemed to be concealed in the interior of the nerve, but which is nothing else than the solution of continuity of the filaments which compose it, and not, as Bichat thinks, a particular tubercle.

1573. Be this as it may, these filaments, of which the number varies from seventy to eighty or a hundred, are evidently separated into two parcels by cellular laminæ or by blood vessels. The anterior and inner is formed of five or six larger, softer and whiter filaments, placed beneath the others, and not contributing by their rupture, to the formation of the mammilla mentioned above (1571.) The other bundle, which is situated posteriorly and externally, contains the rest of the filaments, and advances outwards as far as the extremity of the upper edge of the petrous bone, where it enters a canal furnished by the dura mater (1491,) about five lines long anteriorly and only three behind, and in which the arachnoid membrane soon leaves it forming a cul-de-sac. It thus arrives in the internal temporal fossa, after being much flattened and broadened in passing over the upper edge of the petrous process, which presents a depression for lodging it. Its filaments then cease to be parallel; they separate from each other without interlacing or anastomosing with each other, as happens in the course of other nerves, and all terminate in a depressed, semilunar gangliform or plexiform bulging, of a grayish colour, concave behind for receiving them, flat beneath, where it rests upon the base of the skull, and a little concave above. This sort of ganglion adheres intimately to the dura mater, without its being certain that it furnishes filaments to it. Its tissue seems formed of a net-work of inextricable fibres, and does not permit its original filaments to be followed, they being intimately confounded together.

1574. The anterior edge of this gangliform body or plexus is convex. There successively arise from it, from before backwards, three nervous trunks, viz.: 1st, the ophthalmic nerve, less voluminous, and lodged in the outer wall of the cavernous sinus; 2dly, the superior maxillary nerve, larger and issuing by the great round foramen of the sphenoid bone; 3dly, the inferior maxillary nerve, larger still and escaping by the foramen ovale of the same bone.

1575 The first bundle, which is formed by the five or six white filaments, and does not enter into the ganglion, passes in an isolated manner beneath it, and joins the inferior maxillary nerve.

1. OF THE OPHTHALMIC NERVE, OR FIRST BRANCH OF THE FIFTH PAIR.

1576. This is the smallest and highest of the three branches furnished by the trifacial nerve. It is also that which deviates least from the original direction of the trunk which gave rise to it. It proceeds from behind forwards, from within outwards, and from above downwards, under the dura mater, in the outer wall of the cavernous sinus, from which it is separated, like the common motor nerve of the eye and the pathetic nerve, by distinct laminæ of cellular tissue. From being at first placed beneath the common motor nerve, it becomes superior and internal with respect to it, as we have already said. So long as it is contained within the skull, it has a grayish tint, a very decided plexiform appearance, and an uneven surface. Before arriving at the sphenoidal fissure, through which it passes to the orbit, it receives a filament from the superior cervical ganglion, and then divides into three twigs which perforate the dura mater separately. Of these twigs, one is external, the *lachrymal nerve;* another superior, the *frontal nerve;* and the last internal, the *nasal nerve.*

1577. *Of the lachrymal nerve.* This is the smallest of the three. Separated from the ophthalmic nerve at the moment when it changes its direction to ascend above the motor nerve of the eye, it immediately enters a canal of a few lines long, and which is furnished to it by the dura mater, to which it firmly adheres. It is directed outwards and forwards, enters the orbit, and proceeds along its outer wall, between the periosteum and the abductor oculi, as far as the lachrymal gland and the upper eyelid.

1578. In this course, it gives off a posterior or *spheno-maxillary* filament, which anastomoses with a filament of the superior maxillary nerve towards the anterior extremity of the infra-orbitar fissure, and an anterior or *malar* filament, which enters a canal formed in the substance of the malar bone, and emerges upon the cheek, where it anastomoses with a filament of the facial nerve. The latter filament, and sometimes both, traverse the lachrymal gland before issuing from the orbit.

1579. When the lachrymal nerve has arrived at the gland of the same name, it is situated upon its internal surface, and furnishes it with three or four filaments which are distributed in its tissue, or emerge from it to pass into the tunica conjunctiva.

1580. Lastly, the twig itself, on arriving beyond the gland, proceeds inwards, behind the aponeurosis of the levator palpebræ superioris, and terminates by a great number of filaments in the upper eyelid.

1581. Of the *Frontal Nerve.* Larger than the other two branches of the ophthalmic nerve, it separates from the common trunk later than the preceding, introduces itself into the orbit between the periosteum and the posterior extremity of the rectus oculi superior, proceeds obliquely forwards and outwards, in the direction of the axis of the orbit, and passes to the upper part of the levator palpebræ superioris, where it divides into two twigs, an inner and smaller, and an outer and larger. Sometimes, however, their size is the same. The *internal frontal branch* is directed a little inwards toward the cartilaginous pulley of the obliquus superior oculi, and furnishes at first a filament which descends to anastomose by arches with a filament of the nasal nerve. It then gives off, at the level of the cartilaginous pulley itself, several other twigs which proceed from within outwards into the upper eye-lid, in the substance of which they frequently anastomose by arches with those which terminate the lachrymal nerve. Sometimes these anastomoses are not visible. Several of these same filaments also lose themselves in the anterior surface of the corrugator supercilii and frontalis muscles. One of them penetrates into the frontal sinuses by an aperture of its own, and is distributed to the membrane by which they are lined; but the twig, continuing its course, issues from the orbit between the pulley of the obliquus oculi superior and the superior orbitar hole, is reflected from below upwards, ascends behind the corrugator supercilii and frontalis muscles, gives filaments to their posterior surface, and ends with expanding in the subcutaneous cellular tissue towards the top of the head. The *external frontal branch* proceeds directly forwards, passes through the upper orbitar hole, and most commonly gives off immediately a filament which directs itself transversely outwards, subdivides in the upper eye-lid, anastomoses with those of the facial nerve, and ascends behind the corrugator supercilii. Another filament separates from it at the same level, and gains transversely the root of the nose, where it appears to unite with a filament of the internal frontal nerve. In the interior of the supra-orbitar foramen, sometimes sooner, the nerve itself divides into two ramifications which are reflected over the forehead, behind the corrugator supercilii, and subdivide into a great number of *deep* and *superficial* filaments. The former are distributed in the corrugator supercilii and integuments. The latter, which are much longer, extend over the top of the head, as far as the occiput, anastomose internally with those of the opposite side, externally with those of the facial nerve, posteriorly with those of the first cervical nerves. They only become superficial after perforating the epicranial aponeurosis. Their last divisions have been asserted to have been traced into the bulbs of the hair.

1582. *Of the Nasal Nerve.* More voluminous than the lachrymal, but smaller than the frontal, it penetrates into the orbit between the two posterior attachments of the abductor oculi, situated internally of the common motor, and above the external motor nerve. From thence it proceeds obliquely inwards, forwards, and a little upwards, ascends between the optic nerve and the attollens oculum, gains the inner wall of the orbit under the obliquus superior oculi, and divides into two secondary twigs in the midst of a great quantity of adipose cellular tissue. Frequently, before entering the orbit, this nerve receives a filament from the superior cervical ganglion. On entering it, it gives off a slender filament, about six lines in length, which runs along the optic nerve externally, and proceeds to the upper and back part of the ophthalmic ganglion, after having communicated by one or two small twigs with the upper branch of the common motor nerve of the eye (1364). In passing above the optic nerve, the nasal nerve produces two or three *ciliary filaments*, which are distributed to the ball of the eye, as we shall subsequently point out.

It is at the level of the outer wall of the orbit that the nasal nerve undergoes its last division. The two twigs which result from it are of equal size. One is internal and posterior, and penetrates into the nasal fossæ; the other is anterior, and is distributed externally of the orbit.

1583. *Internal Nasal Twig.* Its course is very remarkable. Accompanied by a small artery, it introduces itself into the internal and anterior orbitar hole, directs itself inwards and upwards in the canal of which that hole is the aperture, issues from it to enter the cranium under the dura mater, which covers it, and keeps it down in a bony groove, until it reaches the sides of the crista galli.—There, it penetrates, without having furnished any filament to the dura mater, and without anastomosing with the olfactory nerve, into a small fissure which exists at the anterior part of the ethmoid grooves, and thus reaches the vault of the nasal fossæ, where it increases in size and subdivides into two filaments, the one internal and the other external.

The first descends over the anterior part of the septum between the two laminæ of the pituitary membrane. After a short passage it divides into two other filaments; one of these, the *Naso-lobaire* of Chaussier, is very thin, and descends upon the posterior surface of the nasal bone, lodged in a bony groove, or even a true canal, which commences at the nasal spine of the frontal bone. It then emerges between the ossa nasi and the lateral portion of the nasal cartilage, increases in size and solidity, and ramifies in the integuments of the lobe. The other, which is a little more slender, descends upon the pituitary membrane, until opposite the edge of the septum, and terminates near its base, by subdividing.

The second furnishes, almost at its commencement, a filament which enters into a bony canal formed behind the nasal bone or on the nasal spine of the frontal bone. It emerges beneath the membrane inferiorly, where it passes through one of the small holes observed on these bones, to terminate in the skin. Afterwards there are seen to arise two or three other filaments, which descend to the anterior part of the outer wall of the nasal fossæ as far as the inferior turbinated bone. Sometimes one of them is contained in a bony canal.

I have not been able to meet with the filaments which several anatomists describe as coming from the internal nasal nerve, in the frontal sinuses and ethmoid cells.

1584. *External Nasal Twig.* It proceeds in the original direction of the nerve, along the inner wall of the orbit, and on arriving beneath the cartilaginous pulley of the obliquus oculi superior muscle, anastomoses with a filament of the internal frontal nerve, issues from the orbit, and divides into several filaments which are distributed to the upper eyelid, where they unite with the filaments of the internal frontal nerve; to the lower eyelid, where they meet those of the infra-orbitar and facial nerves; to the caruncula lachrymalis; the lachrymal sac; the back of the nose, where they frequently anastomose with the ramifications of the first division of the preceding twig; the pyramidalis muscle, and the skin.

2. OF THE SUPERIOR MAXILLARY NERVE.

1585. Larger than the ophthalmic, and smaller than the inferior maxillary, the superior maxillary nerve arises from the middle part of the common bulging of the trifacial nerve, proceeds forwards and a little outwards, and penetrates into the foramen rotundum of the sphenoid bone, to pass into the spheno-maxillary fossa (361). From its origin to this point the nerve, which is at first broad, afterwards contracts, presents a triangular form, and preserves a grayish tint and a very apparent plexiform disposition. At its entrance into the spheno-maxillary fissure, it resembles the other nerves. It traverses the fissure horizontally, introduces itself into the infra-orbitar canal, passes through it, and emerges to be expanded upon the cheek.

1586. *Orbitar Twig.* In traversing the foramen rotundum of the spheniod bone, sometimes in the spheno-maxillary fossa, the superior maxillary nerve furnishes a pretty considerable twig, which directs itself forwards and upwards, and penetrates into the orbit by the spheno-maxillary fissure. It there divides, beneath the depressor oculi muscle, into two filaments. One of these, the *malar*, first anastomoses with the lachrymal nerve, passes through a canal of the cheek bone, is distributed to the orbicularis palpebrarum muscle and the skin, and terminates by uniting with a filament of the facial nerve. The other filament, the *temporal*, passes through the orbitar portion of the same bone, enters the temporal fossa, communicates with a branch of the inferior maxillary nerve, ascends obliquely outwards and backwards, pierces the temporal aponeurosis, becomes subcutaneous, accompanies the superficial temporal artery, anastomoses with some filaments of the facial nerve, and loses itself in the skin of the temples and the top of the head.

1587. In the spheno-maxillary fissure, the superior maxillary nerve receives one or two short and thick twigs, which come from the spheno-palatal ganglion, and proceed, in the midst of the adipose cellular tissue, from above downwards, from within outwards, and from behind forwards, following a course the reverse of that of the nervous trunk. It furnishes, in the same place, the *posterior and superior dentar branches*, of a pretty considerable size, to the number of three or four, and descending upon the maxillary tuberosity, where, after several flexuosities, they enter into apertures which it furnishes for them (245). These apertures transmit them (107), into the canals formed in the substance of the bone, where they divide into several filaments which descend forwards to gain the roots of the last three or four molar teeth. One of these filaments penetrates into the maxillary sinus by a particular orifice, follows its outer wall, and anastomoses with a twig of the anterior dentar nerve. Another of them does not enter the canals of the tuberosities, but turns over the alveolar margin, and is distributed to the gums and the buccinator and pterygoideus internus muscles.

1588. In the interior of the infra-orbitar canal, the nerve of which we speak furnishes no decided branch, but seems divided into several fasciculi which remain connected together and proceed parallel to each other. At its foremost part, however, there is detached inferiorly a pretty considerable twig. This is the *anterior dentar nerve*, which descends in the canal of the same name (239), furnishes to the mucous membrane of the maxillary sinus a filament which anastomoses with one of the posterior dentar nerves, (1587) and divides into several others, which have each their particular canal, and which are distributed to the roots of the incisores, caninus, and first two molares of the corresponding side. Sometimes these nerves creep exposed beneath the membrane of the sinus, and furnish it with some very slender filaments. They also give some ramifications to the pituitary membrane which covers the inferior turbinated bone, and which have particular canals.

1589. *Infra-orbitar Twigs*. They issue from the infra-orbitar canal by the hole of the same name, behind the levator labii superioris, to which they give some very delicate ramifications. They result from the expansion of the superior maxillary trunk itself. Their number is indeterminate, but always considerable. They separate from each other in a radiating manner, and, by their anastomoses with one another and with the facial and buccal nerves, constitute a kind of plexus between the prominence of the cheek and the nose. Of these twigs, some, the *superior* or *palpebral*, which are few in number, are distributed to the lower eyelid, the orbicularis palpebrarum and pyramidalis nasi muscles, the integuments of the cheek, the caruncula lachrymalis and the lachrymal sac, anastomosing with the filaments of the external nasal nerve, (1584) the facial nerve, and sometimes those of the lachrymal nerve which have traversed the cheek bone; others, the *inferior* or *labial*, which are more numerous and larger, furnish ramifications to the levator labii, levator anguli oris, and orbicularis oris muscles, and to the skin, as well as to the mucous crypts of the lips. Others again, the *internal* or *nasal*, are expanded over the back and wing of the nose, in the levator labii superioris alæque nasi, triangularis nasi, and depressor alæ nasi muscles, around the aperture of the nostrils, and communicate with the naso-labar filaments of the internal nasal nerve (1583.) The last, or *external* twigs are distributed to the two zygomatic muscles, the levator anguli oris, and the skin. They form anastomoses with the twigs of the facial nerve.

OF THE INFERIOR MAXILLARY NERVE.

1590. This branch is the largest of those into which the trifacial nerve divides; but its course is shorter within the skull than that of the others. Proceeding outwards and forwards, it issues from the skull by the foramen ovale of the sphenoid bone, and is composed of two distinct portions. Of these portions the outer and larger, which is plexiform, triangular and flattened, comes from the semilunar bulging of the trunk of the nerve; the other which is concealed by this portion, is formed by the larger white filaments of which we have spoken (1573), and is composed of parallel filaments, not united into plexus. These two portions issue separately through the foramen ovale, and only unite in the zygomatic fossa, where the small portion becomes anterior, and appears to be particularly distributed to the buccal nerve and to one of the deep temporal twigs.

1591. Arrived in the zygomatic fossa, between the sphenoid bone and the pterygoideus externus muscle, the inferior maxillary nerve seems to divide into two principal trunks. One, which is superior and external, gives rise to the deep temporal, masseteric, buccal and pterygoid twigs. The other, which is inferior and internal, is larger, and furnishes the inferior dentar, lingual and auricular twigs.

1592. *Deep Temporal Twigs.* They are commonly two and sometimes three in number. In some subjects there is only one. They arise separately or by a common trunk. However this may be, one of them, the anterior, which is sometimes furnished by the buccal nerve, proceeds forwards into the deepest part of the temporal fossa, after being for some time prolonged horizontally between the pterygoideus externus and the upper wall of the zygomatic fossa. The other, which is posterior, and sometimes arises from the masseteric nerve, follows at first the same course, but presently becomes more superficial. Both turn over the temporal bone to ascend between the temporal muscle and the fossa of the same name, and subdivide into a great number of filaments which lose themselves in the substance of that muscle, or anastomose together or with ramifications of the facial nerve, by means of small apertures with which its aponeurosis is perforated. The anterior twig anastomoses moreover with the lachrymal nerve (1578), and with a filament of the orbitar twig of the superior maxillary nerve (1586) which traverses the cheek-bone.

1593. *Masseteric Twig.* Situated behind the preceding twigs, it is nearly of the same size as they, and also proceeds at first horizontally outwards and backwards between the pterygoideus externus and the upper wall of the zygomatic fossa, before the transverse root of the zygomatic process. It then traverses the sigmoid notch of the inferior maxillary bone, between the temporal muscle and the neck of the condyle of the jaw, gives some filaments to the articulation of the jaw, places itself at the inner surface of the masseter muscle, furnishes it with some filaments posteriorly, and at length loses itself, by several other filaments, in the middle part of that muscle, without ever descending to its inferior insertion.

1594. *Buccal Twig.* More voluminous than the preceding, it sometimes arises by a common trunk with the anterior deep temporal nerve (1591), but directs itself from its origin forwards and downwards, passes between the two pterygoid muscles, and gives some filaments to the outer and to the temporal muscle. It then places itself between the pterygoideus internus and the ramus of the jaw, and passes between the coronoid process and buccinator muscle, on which it divides into several filaments, after proceeding some time without dividing, and becoming more and more superficial. All these filaments, to the number of six or seven, anastomose frequently with each other, and come only from the inferior side of the nerve. The first which separate from it are very slender, and go to the temporal muscle; the next are distributed to the buccinator and levator anguli oris muscles, and the skin; the last go as far as the commissure of the lips, pass under the depressor anguli oris, and lose themselves in its vicinity. Several of them communicate with the facial and infra-orbitar nerves.

1595. *Pterygoid Twigs.* There are frequently two, sometimes however only one. They are always extremely small and slender. At first deeply concealed between the pterygoidei and peristaphylinus externus, they direct themselves downwards and terminate in the pterygoideus internus.

1596. *Lingual Twig.* A little smaller than the inferior dentar nerve, it communicates with it, soon after its origin, by a short, but pretty thick filament, which leaves between it and that nerve an interval traversed by the internal maxillary artery. Nearly at the same time the nervous filament known by the name of *Corda Tympani,* and which arises from the spheno-palatal ganglion, as we shall presently show, is united with the lingual nerve, beneath the glenoid fissure, forming a very acute angle above. The latter nerve is sensibly increased in size by this union. Situated at first between the pterygoideus externus and circumflexus palati muscles and the pharynx, this nerve afterwards descends obliquely forwards between the pterygoideus internus and the ramus of the inferior maxillary bone, then enters between the submaxillary gland and the mucous membrane of the mouth. It then passes, along with Warton's duct, between the mylo-hyoideus and hyoglossus muscles, whence it goes to gain the inferior lateral part of the tongue, after ascending above the sublingual gland.

1597. In this course, the lingual nerve gives to the pterygoideus internus muscle a filament which occasionally anastomoses with one of the pterygoid twigs (1595.) It furnishes two or three twigs to the tonsils and to the constrictor pharyngis superior. Farther down, there are detached from it two or three others which lose themselves in the posterior and internal part of the gum. Opposite to the submaxillary gland the corda tympani leaves it to enter into a particular ganglion, which is surrounded by a very small complicated nervous plexus with loose meshes. This plexus results from the reticular interlacing of several filaments which arise from the lingual nerve, and from the ganglion itself, and whose ramifications penetrate the gland on all sides.

1598. Beyond this gland, the lingual nerve sends off several filaments which descend to anastomose with those of the hypoglossal nerve. It furnishes four or five to the sublingual nerve, and about as many to the anterior part of the gums, and to the membrane of the mouth. Then some more considerable twigs issue from its upper edge, and pass between the lingualis and genio-glossus muscles, to be distributed in the tissue of the organ. Lastly, it continues to subdivide in this organ, as far as its point, and ascends towards its upper surface to be distributed by a great number of fasciculate, penicilliform filaments, folded in the direction of their length, in its mucous membrane. Some of them have been traced into the papillæ by which it is covered, particularly at its fore part.

1599. *Inferior Dentar Twig.* A little more voluminous than the preceding, from which it receives a filament (1596,) it descends by its side, at first between the two pterygoid muscles, then between the pterygoideus internus and the ramus of the jaw. In this second part of its course, it is separated from the pterygoideus internus and lingual nerve by the internal lateral ligament of the temporo-maxillary articulation (614).

Arrived near the middle of the internal surface of the ramus of the jaw, this nerve gives off a twig, (the *mylo-hyoid* of Chaussier,) which descends forwards in a groove formed upon that bone, and in which it is retained by a fibrous expansion of the same internal lateral ligament. It is accompanied by a small artery and vein. After emerging from the groove, it places itself between the maxillary bone and the mylo-hyoideus muscle, gives some filaments to the submaxillary gland, approaches the chin, separates into other four or five filaments, and is distributed to the mylo-hyoideus, genio-hyoideus and digastricus muscles.

At the moment when it furnishes this twig, the dentar nerve itself passes into the inferior dentar canal (290) along with an artery and a vein. It passes through its whole extent, furnishing twigs to all the roots of the teeth, from the last large to the first small grinder inclusive; but opposite the mental hole (284) it divides into two branches. One of these, the smaller, remains in the substance of the jaw, and is distributed to the roots of the canine teeth and incisors. The other, which is larger, emerges by the mental hole, and divides into a great number of filaments which are distributed to the triangularis, quadratus, levator menti, buccinator and orbicularis oris muscles, and anastomose with twigs of the facial nerve. Most of these filaments commence with ascending between the membrane of the mouth and the muscles. Others go to the free edge of the under lip, where they form a sort of plexus, the mucous follicles which occur in it, and the skin of the neighbouring parts.

1600. *Auricular* or *Superficial Temporal Twig.* Its origin takes place sometimes by a single root, sometimes by two, in the interval of which passes the middle meningeal artery. It then winds backwards and outwards between the condyle of the jaw and the auricular canal, and there it gives off two filaments which anastomose with the facial nerve. Then, covered by the parotid gland, it ascends deeply before that canal, furnishes a filament to the temporo-maxillary articulation, and gains the base of the zygomatic process, after giving off ramifications to the deep parts of the ear, and especially to the skin of the meatus auditorius, at which they arrive by passing between its bony and its fibro-cartilaginous portions. Several of them spread a little farther upon the pavilion and in the concha. It then divides into filaments, the one anterior, the other posterior, which subdivide and accompany the branches of the temporal artery, and are spread out in the integuments of the temple, forehead, and top of the head, anastomosing frequently with those of the facial nerve and of the occipital twig of the second cervical nerve. The posterior filament in particular sends a great number of ramifications to the external ear, that is to say, to the helix and the prior auriculæ and attolens auriculam muscles.

OF THE EXTERNAL MOTOR NERVE OF THE EYE, OR SIXTH PAIR OF NERVES.

1601. At first sight this nerve would seem to arise from the groove which separates the annular protuberance from the spinal marrow; but a little attention shows that its roots are situated beside the pyramidial eminences, along which they ascend as far as the groove, where they divide into two distinct bundles, which the last fibres of the protuberance sometimes cover, and which quickly unite a little more anteriorly. Each of these bundles is composed of two or three filaments placed behind each other.

1602. The nerve, thus formed, is intermediate in size between the pathetic and common motor nerves. It is surrounded with a neurilemma from the moment when it appears under the protuberance. It proceeds forwards, upwards and outwards, along the basilar groove, to beneath the posterior clinoid process, where it perforates the dura mater on the sides of the quadrilateral plate of the sphenoid bone. It then enters the cavernous sinus, in the interior of which it is accompanied to a certain distance by the arachnoid membrane, which has furnished it with an envelope from its commencement. It is situated externally of the internal carotid artery, with which it is connected by a pretty dense cellular tissue, and is separated from the blood of the sinus by a fold of the internal membrane of the latter. In the sinus itself, it is directed outwards and downwards, and acquires a reddish tint and a somewhat larger volume. In passing above the orifice of the carotid canal, it receives from behind forwards two or three grayish and soft filaments which come from the superior cervical ganglion.

1603. The external motor nerve enters into the orbit by the sphenoidal fissure. The dura mater affords it a particular aperture above that of the ophthalmic vein. It passes between the two posterior fasciculi of the rectus externus of the eye, along with the common motor and nasal nerves, with which it is pretty intimately connected. Then, prolonging itself along the ocular surface of that muscle, it loses itself entirely in its substance by several filaments which penetrate it in a divergent manner.

OF THE FACIAL NERVE, OR PORTIO DURA OF THE SEVENTH PAIR.

1604. The real origin of this nerve is distinguished with great difficulty, and it cannot be made to come in a clear manner from a remote part of the spinal marrow. It becomes apparent immediately behind the posterior edge of the annular protuberance, in its angle of union with the restiform body, some lines to the outside of the preceding, one line only before the acoustic nerve. It forms at first a flat, very white, soft cord, not enveloped by the neurilemma, and adhering for some time, by its upper edge, to the peduncle of the cerebellum. Some very slender filaments then join it, and seem to be detached from the acoustic nerve. Their connection with the latter nerve is seldom evident, but they always form a distinct origin between those of the two nerves themselves.

1605. After becoming free, the facial nerve is invested with a neurilemma, and continues to proceed outwards, upwards, and forwards, applied in a sort of groove formed upon the acoustic nerve, with which it penetrates into the internal auditory canal, and which it afterwards leaves to pass into the aqueduct of Fallopius (180.) It passes through this canal in its whole extent, and issues from it by the stylo-mastoid hole to be spread out upon the face.

1606. Opposite the hiatus Fallopii, the upper filament of the vidian nerve is applied from behind forwards upon the facial nerve, without really anastomosing with it. A little farther on, there is detached from it a very minute filament which loses itself in the internal muscle of the malleus, after passing through a small aperture formed in the bone. At the posterior wall of the cavity of the tympanum, another filament, still smaller, traverses the base of the pyramid, and throws itself into the muscle of the stapes. Still lower, the upper branch of the vidian nerve separates from it anew, descends parallel to it for some time, is reflected upwards and outwards, and introduces itself into the cavity of the tympanum by an aperture situated beneath the pyramid. This branch then takes the name of *Chorda tympani*.

1607. In passing through the stylo-mastoid hole, the facial nerve furnishes several twigs which go to the neighbouring parts, of which the most considerable is the

1608. *Posterior auricular Twig.*—It descends at first deeply for a few lines, is then reflected upon the anterior part of the mastoid process, from whence it is directed behind the pavilion of the ear. There it divides into two filaments, an *anterior*, which ramifies upon the internal surface of the pavilion, and gives some filaments to the posterior auricular muscle, and a *posterior*, which is expanded by subdividing upon the mastoid process, and in the occipitalis muscle and the neighbouring integuments. These ramifications anastomose with those of the cervical plexus.

The other twigs which the facial nerve furnishes at the same point, are the following:—

1609. *Stylo-hyoid Twig.*—This twig sends several filaments to the muscles which arise from the styloid process of the temporal bone. One or two of these filaments traverse the stylo-hyoideus muscle, and anastomose with the filaments of the superior cervical ganglion.

1610. *Infra-mastoid Twig.*—It passes into the posterior belly of the digastric muscle, passes through it after furnishing it with some filaments, and divides into two filaments. One of these ascends inwards behind the internal jugular vein, and anastomoses with the glosso-pharyngeal nerve at the moment when it issues from the skull. The other descends along the styloid process, and unites with the superior laryngeal twig of the pneumo-gastric nerve.

1611. After furnishing these three twigs, the trunk of the facial nerve itself enters into the parotid gland, where it is at first deeply concealed, but whose surface it approaches by descending obliquely forwards. At the end of a passage of seven or eight lines, it divides into two branches: a *superior* or temporo-facial, which is larger, and an *inferior* or cervico-facial, which is smaller.

1612. *Temporo-facial Branch.* It proceeds forwards and upwards, into the substance of the gland, towards the neck of the condyle of the jaw, of which it crosses the direction, and behind which it sends one or two filaments to anastomose with those of the superficial temporal nerve (1590). It then divides into seven or eight twigs, which are diffused in a radiating manner over the temple and face, and which are distinguished, according to their position, into the following.

1613. *Temporal Twigs.* These are two or three in number. They are rather small, and direct themselves obliquely upwards and forwards toward the temple, crossing the direction of the zygomatic arch. They give at first some filaments to the parotid gland, which covers them at their origin. Above the zygomatic arch, they subdivide into a considerable number of filaments, which spread over the forehead and temple, as far as the summit of the head, between the integuments and the temporal aponeurosis. These filaments ramify in the anterior part of the pavilion of the ear, in the prior auriculæ, attollens auriculam, frontalis, temporalis and orbicularis palpebrarum muscles, and in the integuments. They anastomose with the filaments of the superficial temporal (1600), posterior auricular (1608), deep temporal (1592), and frontal (1581) nerves, the orbital twig of the superior maxillary nerve (1586), the lachrymal nerve (1577), and those of the cervical plexus. There are also frequent communications established between them and the following twigs, so that they truly present a very complicated net-work beneath the skin of the temples.

1614. *Malar Twigs.* Two or three in number, they ascend forwards towards the malar bone, where they spread out into a great number of filaments. The *superior* twig, united by an arch with the last of the temporal twigs, directs itself towards the inner angle of the eye, and terminates there by anastomosing with one of the filaments of the external nasal nerve (1584). Conjointly with the other two, it forms a very apparent plexus on the cheek, more superficial behind than before, which sends numerous filaments into the zygomatic muscles, the orbicularis palpebrarum, levator anguli oris and levator labii superioris, and into the skin of the lower eyelid and upper part of the cheek. These filaments, besides their mutual communications, unite also with those of the lachrymal (1577), infra-orbitar (1589), internal frontal (1581), and external nasal (1584) nerves, and accompany all the divisions of the facial vein, forming around it a more or less prolonged nervous net-work.

1615. *Buccal Twigs.* These are three or four in number. They emerge from beneath the parotid gland towards the middle of the masseter muscle, communicate with the preceding twigs, and with the cervico-facial branch, and follow a nearly horizontal direction. The *upper* gains the sides of the nose, and supplies the zygomatic, levator anguli oris, levator labii superioris, and levator labii superioris alæque nasi muscles. The *middle* twig is the largest of those of the temporo-facial branch. It frequently arises by a common trunk with the upper, proceeds beneath Steno's duct, whose direction it follows, passes transversely over the buccinator muscle, arrives at the commissure of the lips, and gives filaments to the upper lip, as well as to the muscles and skin of the neighbouring parts. The *lower* twig follows nearly the same direction, and gains the under lip. All the filaments which proceed from these different twigs form a plexus similar to those which we have just pointed out, and communicate with theirs, or with those of the infra-orbitar (1589), mental (1599), and buccal (1594). With the latter especially they form numerous anastomoses which are observed around the facial artery and vein, and which send secondary filaments along their divisions.

1616. *Cervico-facial branch.* It descends obliquely downwards in the substance of the parotid gland, behind the ramus of the jaw, towards the angle of which it dives under the platysma myoides, directing itself forwards. The twigs which it furnishes are distinguished into those which arise from it above the base of the jaw, and those which separate from it under that point.

1617. *Supra-maxillary Twigs.* They are two in number. The *upper*, which is pretty large, arises from the right angle immediately beneath the lobule of the ear, and directs itself transversely forwards over the lower part of the masseter muscle, concealed for some time by the parotid gland. It then dives under the platysma myoides and triangularis muscles, dividing into four or five filaments which are distributed to these muscles, to the buccinator, orbicularis oris, and the integuments. Some of these filaments ascend towards the cheek-bone, others descend towards the lower lip. All of them have frequent anastomoses with the preceding and following twigs, and with the infra-orbitar, mental, and buccal nerves.

The *lower Twig* turns over the angle of the jaw, sending some filaments to the lower part of the masseter and pterygoideus internus muscles, and covered by the platysma myoides. It then directs itself obliquely forwards and downwards over the outer surface of the masseter muscle, crossing the direction of its fibres, and dividing near its anterior edge into several filaments which throw themselves into the same muscles as those of the preceding twig, and moreover into those of the lower lip and chin, as well as into the skin of these parts. They have also precisely similar anastomoses.

1618. *Infra-maxillary Twigs.* These twigs are two or three in number, arise together or separately, and are even sometimes united at their origin with the lower supra-maxillary twig. They descend forwards and downwards over the anterior and superior part of the neck, covered by the platysma myoides. Towards the angle of the jaw, they divide into a great number of divergent filaments which follow the base of the bone anastomosing with the supra-maxillary and mental twigs, and are distributed to the integuments of the neck and the platysma myoides, where they unite with some filaments of the cervical plexus.

1619. The disposition of the facial nerve, such as it has been indicated above, is not constant. It presents extremely numerous individual varieties, and seldom offers the same arrangement in two different subjects. That which we have described, however, is its most common disposition. On account of its very numerous anastomoses, several authors have called it the *Small sympathetic nerve.*

OF THE ACOUSTIC* NERVES, OR PORTIO MOLLIS OF THE SEVENTH PAIR OF NERVES.

1620. The *Acoustic Nerve* arises transversely over the restiform body, from the substance of a small gray band, a little prominent, which constantly covers the base of this nerve, and which unites it to the floor of the fourth ventricle. Most commonly some of its roots traverse this cord, and are manifestly continued into the upper two of the white striæ which are observed upon the sides of the calamus scriptorius (1443). There is observed, moreover, a kind of small band which seems to unite the two origins of the acoustic nerves and furnish them with a commissure. It is covered by the posterior layer of the protuberance.

The acoustic nerve begins to be separated from the substance of the brain in a small excavation, nearly of a triangular form, placed between the olivary eminence, the peduncle of the cerebellum, the protuberance and the restiform body. This excavation also contains the facial nerve, which, besides its distinct origin, is further separated from the acoustic nerve by a small process of the spinal marrow, which passes between them, and by some small vessels. Thus far the nerve is soft and pulpy; but it now assumes the appearance of the other nerves, that is to say, it is composed of numerous filaments, invested by a neurilemma. Of a volume equal to that of the common motor nerve, it also becomes more consistent than the olfactory nerve, but it nevertheless remains softer than the other nerves.

In proportion as it retires from the encephalon, it forms a flattened cord, as it were rolled up upon itself, and marked internally by a groove in which the trunk of the facial nerve is lodged. All the filaments which enter into its composition are very delicate, and anastomose with each other, so as to form a very complicated and dense plexus. Only at its back part, there is observed, almost from its commencement, a whiter and softer cord than the rest, which is not formed of filaments. It seems homogeneous and pulpy. Moreover, the intermediate filaments which commonly direct themselves towards the facial nerve, and of which we have made mention, sometimes intermingle with its own filaments, after forming a small plexus by themselves.

The acoustic nerve proceeds parallel to the facial, so long as it is contained within the skull. It introduces itself along with it into the internal auditory canal (177), where its plexiform structure becomes more and more apparent, and at the bottom of which it divides into two branches.

1621. *Branch of the Cochlea.* This branch is formed by the white and unfilamentous cord which is distinguished at an early period behind the rest of the nerve. It directs itself a little forwards and upwards towards the bottom of the internal auditory canal, and on arriving at the base of the cochlea, divides into a great number of very slender filaments. All these filaments enter into an equal number of small apertures which this base presents, and thus penetrate into the cochlea, parallel to its axis. They then spread out their ramifications upon the lamina spiralis, which divides it into two scalæ. They are so much the shorter and more delicate the nearer they are observed to the summit, and they all form, on the membranous part of that lamina, a very dense and very thick network. For this distribution of filaments, the nerve is twisted upon itself round the axis of the cochlea, and the twig which terminates it passes through the central canal, and is distributed to the infundibulum and the last half turn of the spiral lamina. It is larger than the others.

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* Ακȣ́ω, audio.

1622. *Branch of the Vestibule and Semi-circular Canals.* Its bundle, united at first to the preceding, separates from it in the internal auditory canal, proceeds backwards and outwards, forms a grayish, gangliform bulging, from which emanate three twigs of different sizes.

1623. *Great Twig.* Larger than the others, behind which it is situated, it enters into the vestibule by several porosities, and there separates into two portions, after leaving its envelopes and becoming whiter. One of these portions spreads out in the vestibule itself, and forms a sort of nervous membrane composed of very delicate reticulated, and, as it were, diffluent ramifications. The other advances towards the approximated orifices of the superior vertical and horizontal semicircular canals. Here it bifurcates, mingles with the kind of pulp which bulges in the form of ampullæ at their origin, and thus disappears in a manner still unknown.

1624. *Middle Twig.* This twig, which is divided into two filaments, and immediately enters into the vestibule, loses itself in the membrane which lines that cavity by a multitude of very subtile, very soft, and very white ramifications.

1625. *Small Twig.* Placed beneath the others, it enters into the vestibule by a single aperture, which is observed at the outer part of the internal auditory canal. It directs itself towards the posterior vertical semicircular canal, and seems to be prolonged in its interior after being expanded upon the pulpy ampulla which is observed at its orifice.

OF THE GLOSSO-PHARYNGEAL NERVES.*

1626. The *Glosso-pharyngeal Nerves* come from the upper and lateral parts of the spinal marrow, between the facial and pneumo-gastric nerves, but nearer the latter, in the groove which separates the corpora olivaria from the restiform bodies. This origin is composed of two, three, four, or five filaments, more or less separated, and sometimes united into a single root, which is separated from the pneumo-gastric nerve by vessels, by a lamellar process of the circumference of the cerebellum, or by a small portion of the choroid plexus of the fourth ventricle (1484). These filaments being united, constitute a bundle placed above and before the trunk of the pneumo-gastric nerve, and proceed directly outwards towards the anterior part of the foramen lacerum posterius. There, the glosso-pharyngeal nerve enters an isolated canal, which is furnished by the dura mater, passes through the foramen, and on emerging, is separated from the pneumo-gastric nerve by the trunk of the internal jugular vein. It then directs itself downwards and forwards, passes over the internal carotid artery, following its direction as far as the posterior and inferior part of the tongue, into which it penetrates.

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* Γλῶσσα, *lingua*; φαρυγξ, *pharynx*.

1627. Immediately after emerging from the skull, the glosso-pharyngeal nerve throws one of its ramifications into the auditory canal. It sends off another upon the promontory of the tympanum, to anastomose, after penetrating that cavity, by a hole formed near the stylo-mastoid foramen, with one of the branches of the superficial petrous filaments of the vidian nerve. It then receives a filament which comes from the stylo-hyoid twig of the facial nerve (1609,) and another which the trunk of the pneumo-gastric nerve sends to it (1633). It afterwards furnishes two long and slender filaments, which descend upon the internal carotid artery, giving off in their course several filaments which anastomose with the pharyngeal branch of the pneumo-gastric nerve, or throw themselves into the plexus of the same name. These two filaments continue to descend internally of the common carotid artery to the lower part of the neck, where they unite with twigs from the cervical ganglia, and particularly with some of the cardiac nerves. After them, the glosso-pharyngeal nerve sends two others into the stylo-pharyngeus muscle. It also furnishes two considerable twigs, isolated or united at the moment of their origin, and which come off from it opposite the summit of the styloid process or a little lower. These descend inwards and backwards, and in passing give off ramifications to the upper and middle constrictors of the pharynx, and to its mucous membrane. One of these ramifications throws itself into the tonsil. Two or three others lose themselves in the stylo-pharyngeus muscle, and some of them gain the superficial and posterior part of the tongue. The twigs, still continuing to descend, are dispersed in the pharyngeal plexus.

1628. After furnishing these different branches, the nerve itself enters beneath the stylo-glossus and hyo-glossus muscles. It then divides into three orders of twigs. The *superior* pass into the lingualis and glosso-staphylinus muscles, and into the neighbouring mucous crypts. These, together with a filament already described

(1608,) form around the tonsil a true plexus, the *circulus tonsillaris*, and furnish it with distinct filaments. The *inferior* descend into the hyo-glossus muscle and the glosso-epiglottic mucous folds (1406.) Those of the latter part send off one or two which fall upon the epiglottis, but can only be traced with great difficulty into the tissue of that organ. The *middle* twigs, or those of the third order dive into the fibres of the tongue, under the hyo-glossus muscle, ascend to the upper surface of that organ, and lose themselves in its mucous follicles, spreading but very little in its muscular tissue.

1629. The glosso-pharyngeal nerve is situated, in the tongue, above the hypoglossal nerve, and under the lingual twig of the inferior maxillary nerve. It is smaller than these nerves, and does not appear to anastomose with their filaments.

OF THE PNEUMO-GASTRIC NERVES, PAR VAGUM, OR NERVES OF THE EIGHTH PAIR.

1630. The *Pneumo-gastric Nerves* arise immediately under the preceding, behind the olivary eminences, and very near the restiform bodies, by one or two rows of filaments, from five to six lines in length, and regularly disposed. These filaments, which are very numerous, and more commonly bifurcated and very slender, are never prolonged so far as the ventricle of the cerebellum. They are from their commencement enveloped by the neurilemma, and present a remarkable degree of firmness. United at first into six, eight, or ten larger bundles, placed under each other, they form a broad and thin ribbon, in which they remain parallel without communicating with each other. This ribbon, surrounded by the arachnoid membrane, directs itself outwards and forwards, arrives at the foramen lacerum posterius, and passes through it in a particular canal of the dura mater, inferior to that of the glosso-pharyngeal nerve, which has thus no communication with the pneumogastric nerve. A very apparent fibrous septum in fact separates the one from the other in this part of their course. Another septum, sometimes osseous in whole or in part (210,) separates them both from the internal jugular vein, which is placed between them inferiorly.

1631. Immediately after issuing from the skull, the pneumogastric nerve has the form of a round cord. All the filaments which compose it anastomose with each other for the extent of about an inch, and give it the appearance of a very close and dense plexus, and sometimes that of a ganglion. In this part, it is always a little swollen, and has a grayish tint. It is also there intimately connected with the hypoglossal, spinal accessory and glosso-pharyngeal nerves by a dense, firm, strongly adherent cellular tissue, destitute of adipose substance, and in which are also immersed the ascending filaments of the superior cervical ganglion.

1632. The pneumo-gastric nerve is at first placed before the hypoglossal, but almost immediately becomes posterior to it as it descends, and is entirely separated from it at the level of the transverse process of the atlas. It then passes over the rectus capitis anticus major and longus colli muscles, externally of the common carotid artery and behind the internal jugular vein, to which it is united, as well as to the communicating cord of the cervical ganglia, by cellular tissue less dense than that which surrounded it at its exit from the skull, but, like it, destitute of fat, filamentous and membranous.

Arrived at the inferior part of the neck, the trunk of the pneumo-gastric nerve enters the thorax, gliding behind the subclavian vein, and is differently distributed to the right and left. In the former direction, it passes before the subclavian artery; in the latter, before the arch of the aorta. It passes at first backwards, and increases in size. When situated behind the trunks of the bronchi, it leaves them to accompany the œsophagus through the diaphragm, and terminates upon the stomach. In the latter part of its course, the nerve of the right side is manifestly placed much farther back than that of the left side.

1633. In the very interior of the foramen lacerum posterius, the pneumo-gastric nerve sends off one or two filaments to anastomose with the spinal nerve, and, on emerging, it communicates with the glosso-pharyngeal nerve (6199) by another filament which describes a curve, from the convexity of which escape some ramifications which lose themselves in the rectus capitis anticus major. It also anastomoses with the hypoglossal nerve, and with ramifications of the superior cervical ganglion.

1634. *Pharyngeal Twig.* Close upon the filament of communication with the glosso-pharyngeal nerve, and either above or beneath it, the pneumo-gastric nerve gives off to the walls of the pharnyx a twig of considerable size, which at the moment of its origin is joined by a filament of the spinal nerve. This twig descends obliquely inwards behind the internal carotid artery, whose direction it crosses, and to which it is closely united opposite the atlas. There, it furnishes one or two filaments which unite with those which the glosso-pharyngeal nerve sends around that artery, and form with them a kind of reticulated plexus which embraces it. The twig then approaches the pharnyx, increases considerably in size, and divides into a great number of filaments towards the upper edge of the constrictor pharyngis medius. These filaments anastomose in a multitude of different directions with filaments of the glosso-pharyngeal nerve, of the upper laryngeal twig, and of the first cervical ganglion. They constitute with them the *pharyngeal plexus*, whose irregular meshes, varying in number in different individuals, send numerous and frequently very extended ramifications, over the whole pharynx. Some among them which, like the plexus itself, have a grayish tint, ascend in the constrictor superior, while others descend in the inferior. One or two follow the internal carotid artery, and anastomose with filaments of the cervical ganglion upon the common carotid artery.

1635. *Superior Laryngeal Twig.* Separated from the trunk beneath the preceding, and at a greater or less distance from it, this twig, which is thicker, more rounded and whiter, slips in the same manner behind the carotid artery, descends externally of the superior cervical ganglion, forms an arch around its inferior extremity, and divides into two secondary twigs, an outer and an inner, after anastomosing by some filaments with the superior cervical ganglion, and with the hypoglossal nerve, and after throwing some others into the pharyngeal plexus.

The *External Laryngeal Twig* descends downwards and inwards, arrives upon the sides of the larynx, gives off, to the sterno-thyroideus, hyo-thyroideus, constrictor pharyngis inferior and crico-thyroideus muscles, filaments some of which penetrate into the larynx between the thyroid and cricoid cartilages. Some of these ramifications are prolonged as far as the thyroid gland.

The *Internal Laryngeal Twig* directs itself inwards behind the thyro-hyoideus muscle, between the hyoid bone and thyroid cartilage, traverses the membrane which unites them and spreads out immediately into several radiating filaments which become thicker and softer in a very obvious manner as they separate from each other. The *upper* filaments ascend on the fore part of the epiglottis and its gland, to which they are distributed, as well as to the membrane of the pharynx, sometimes anastomosing on the median line with those of the opposite side. Several of them which creep at the surface of the epiglottis enter into the holes with which that fibro-cartilage is perforated, as Bichat has remarked; but they cannot be followed upon the opposite surface. The *lower* filaments, which are larger, are distributed in the mucous membranes of the larynx and pharynx, and to the arytenoid gland and muscle. One of them, which is less remarkable for its size than for its course, descends between the thyroid cartilage and the thyro-arytenoideus muscle, then between the cartilage and the crico-arytenoideus lateralis, to throw itself entirely into the crico-thyroideus muscle. Sometimes it is contained in a canal formed in the substance of the cartilage. These ramifications never extend to the other muscles of the larynx, for which is reserved the inferior laryngeal nerve. Some of them anastomose, upon the mucous membrane with ascending filaments of the latter nerve.

1636. Beneath the laryngeal nerve, the pneumogastric nerves, descending along the neck, give off a filament which goes to unite with the cervical branch of the hypoglossal nerve, another which joins the first cervical pair, and two or three grayish and delicate filaments which go to the internal carotid artery, and lose themselves in its walls at the moment when it separates from the external.

1637. *Cardiac Twigs.* The pneumogastric nerves constantly furnish twigs of a larger size, and differently distributed to the right and left, which seem destined to join the nervous plexus of the heart. The nerve of the right side gives off its twigs at about an inch above the origin of the corresponding carotid artery, to which they are attached, descending externally and prolonging themselves over the arteria innominata, to be finally lost in the cardiac filaments of the inferior cervical ganglion. The upper is more constant and larger than the inferior twigs, of which there are two or three.

The nerve of the left side commonly sends off only a single twig, which descends along the carotid artery, spreads out upon the arch of the aorta, and loses itself in the neighbouring cardiac plexus. It seldom furnishes any other twig.

1638. *Inferior* or *Recurrent Laryngeal Twigs.* These twigs present considerable differences in the different sides. They arise from the trunk of the pneumogastric nerve, in the interior of the thorax, and ascend to be distributed to the neck.

That of the right side comes off opposite the inferior edge of the sub-clavian artery, proceeds backwards and inwards, bends upwards behind that artery and in such a manner as to embrace it, places itself behind the common carotid and inferior thyroid arteries, is applied upon the side of the trachea, occupies the groove which separates it from the œsophagus, and arrives at the larynx. At the moment of its commencement, the inferior laryngeal nerve gives off two or three filaments which unite with the cardiac filament of the pneumogastric trunk and with those of the inferior cervical ganglion, and form with them a plexus between the subclavian artery and the trachea. A little higher, it furnishes some others of variable number, which descend upon the fore part of the trachea, throw themselves in part into the plexus formed by the preceding filament, and accompany in part the right pulmonary arteries. Some of their ramifications lose themselves in the anterior cardiac plexus. Along the trachea, there come off some others which are distributed in the walls of the œsophagus, where they anastomose with those of the opposite side and with those of the cervical ganglia, or which are spread out at the upper and superficial part of the thyroid gland, or which, perforating the posterior membrane of the trachea, ramify upon the internal surface of that canal, supplying its mucous crypts. But at the inferior part of the larynx, the recurrent nerve sends filaments to the constrictor pharyngis inferior, under which it glides, and divides into two or three secondary twigs. One of them furnishes subdivisions to the mucous membrane of the pharynx, behind the larynx, the others give filaments to the posterior and lateral crico-arytenoidei, and passing through the crico-thyroid membrane, terminate in the thyro-arytenoideus muscle and the mucous membrane of the larynx, where there are some communications between them and the filaments of the internal superior laryngeal nerve (1635.) The other muscles of the larynx do not receive any.

The left inferior laryngeal nerve differs from the preceding, in having its origin much lower in the thorax, in describing at its commencement a much larger arch, as it turns round the arch of the aorta, and in the circumstance that its pulmonary and cardiac filaments belong to the posterior part of the pulmonary artery and heart.

1639. After giving rise to the inferior laryngeal twigs, the pneumo-gastric nerve, in the interior of the thorax, gives off numerous filaments opposite the bifurcation of the trachea. Three or four descend upon its anterior surface, subdivide and anastomose a great many times with those of the inferior laryngeal twig and inferior cervical ganglion, with which they concur to form the *pulmonary plexus.* Some of these ramifications lose themselves separately upon the pulmonary artery and the anterior part of the bronchi, which they accompany for some time. Three or four other filaments direct themselves behind the trachea, and are partly distributed to its membranous portion and mucous crypts, and partly ramify on the œsophagus. They also throw some subdivisions into the pulmonary plexus.

1640. Immediately before arriving at the bronchi, the trunk of the nerves increases considerably in volume. Its filaments separate from each other, and form a kind of areolar web, with meshes more or less wide and numerous, in which are lodged vessels enveloped by a great quantity of cellular tissue. This disposition of the filaments of the nerve has here the appearance of a true plexus, and is in fact the commencement of the *pulmonary plexus.* It is from hence that most of the ramifications proceed which the pneumo-gastric nerve gives to that plexus, one of the most complicated in the body; for, besides the different filaments which we have already seen to enter into its composition, it receives others still from the inferior cervical ganglion and the first thoracic ganglia. It occupies the posterior part of each lung, where it forms a network in which are contained many lymphatic ganglia of the bronchi. This network sends off on all sides slender filaments, having few ramifications, but communicating pretty frequently together, which appear destined for the mucous membrane and crypts of the bronchi, on which they subdivide to infinity, without appearing to belong to the parenchymatous tissue or blood-vessels of the lung.

1641. After separating from each other opposite the pulmonary plexus, the different filaments of the pneumo-gastric nerves reunite, and form two elongated cords which descend along the œsophagus, and which, for this reason, are called the *œsophageal cords.*

The *œsophageal cord of the right side* seems formed by four or five principal twigs, which issue from the inferior region of the corresponding pulmonary plexus, and descend over the lateral and posterior parts of the œsophagus. Before finally uniting, these twigs, at first very distant from each other, have frequent communications together.

The *œsophageal cord of the left side* is constituted by two or three twigs only, which come in the same manner from the left pulmonary plexus. It proceeds upon the anterior side of the œsophagus.

The two œsophageal cords frequently communicate together by several filaments, which descend from the right to the left, passing before the œsophagus, and by other more numerous filaments, which descend from the left to the right, proceeding behind that canal. Moreover, both of them give numerous ramifications to its walls, and send filaments over the aorta. Inferiorly, they issue from the thorax by the œsophageal aperture of the diaphragm (872.)

1642. On entering the abdomen, the right œsophageal cord, which is larger than the left, and closely attached to the straight and posterior part of the œsophagus, divides and subdivides so as to form around the cardia a very complicated plexus, the filaments of which are expanded over the stomach and neighbouring organs.

The *Stomachic Filaments* belong to the posterior surface of the stomach, and direct themselves from the small to the great curve, sinking into the substance of its walls, and becoming in consequence less and less superficial.

Some of them run along the small curve, behind the coronary artery of the stomach, communicate with the filaments of the left side, and lose themselves beyond the pylorus.

The other filaments throw themselves into the hepatic, splenic, cœliac, and right gastro-epiploic plexus, and are interlaced with the numerous radiations of the solar plexus. Several expand upon the vena portæ, or go to the pancreas, duodenum, and gall-bladder.

1643. The left œsophageal cord divides into several longitudinal filaments, which proceed from the cardia to the pylorus along the small curve of the stomach, and send ramifications over the anterior surface of that organ. These, like the ramifications of the posterior surface, are at first superficial, and afterwards dive into the substance of the muscular coat. The original filaments, on arriving at the pylorus, communicate with those of the right side, or follow the pyloric artery, to cast themselves into the hepatic plexus.

1644. The pneumo-gastric nerve, on account of its very extensive distribution and numerous communications, is by many authors called the *Middle Sympathetic Nerve*. It presents a multitude of variation in its secondary divisions, insomuch that it is rare to find it alike in two subjects.

OF THE SPINAL NERVES, OR ACCESSORY NERVES OF WILLIS.

1645. The *Spinal* or *Accessory Nerves* arise from the spinal marrow in the interior of the vertebral canal, at a more or less considerable distance from the skull, and at a height which is not always the same on both sides in the same subject. Their first point of origin generally occurs at the lateral and posterior part of the spinal marrow, above the posterior root of the fourth cervical nerve. Sometimes it is met with lower, that is to say, opposite the sixth or seventh vertebra of the same region, rarely higher towards the second or first. This first filament, which is frequently larger on one side than the other, ascends, either between the two roots of each cervical nerve, or behind them, near the corresponding ligamentum dentatum. At each origin of these nerves, it increases in volume, new filaments being then added to it. These seem themselves formed by the union of several filaments which issue from the spinal marrow, and direct themselves outwards and upwards, being more oblique the higher they are. The last is very near the pneumo-gastric nerve.

1646. Thus formed, the spinal nerve communicates in the interior of the vertebral canal with the suboccipital nerve, and sometimes with the first cervical nerve, and enters the skull by the occipital hole, behind the vertebral artery, without producing a ganglion, as is asserted. It then proceeds much more outwards and a little forwards, gains the foramen lacerum posterius under the pneumo-gastric nerve, introduces itself into the same canal with it, and is separated from it only by the arachnoid membrane. It even frequently adheres so strongly to it, that they might be taken for a single trunk, and before emerging it sends it a pretty considerable filament.

1647. On emerging from the foramen lacerum posterius, the spinal nerve separates from the pneumo-gastric, to adhere strongly to the hypoglossal, which it leaves in its turn, to proceed towards the sterno-cleido-mastoideus muscle, passing behind the internal jugular vein. It traverses the sterno-cleido-mastoideus at the level of its upper third, and passes under the trapezius, in which it is entirely lost.

1648. The first twig which it gives off in this course is the largest of all, and presents numerous variations. It appears solely destined to augment the size of the pneumo-gastric nerve. Arising in the interior of the fibrous canal which is furnished by the dura mater, it sends one or two filaments to the pharyngeal twig of that nerve (1634,) then passes behind it, adheres intimately to it, and frequently gives a filament to the hypoglossal nerve. Then, arriving beneath the origin of the superior laryngeal twig (1635,) it appears to form a ganglion, and divides into several filaments which lose themselves among those which compose the trunk of the pneumo-gastric nerve, which at this place presents a plexiform appearance.

1649. In traversing the sterno-cleido-mastoideus muscle, it sends off two or three filaments which lose themselves in its fleshy fibres, and one or two twigs, which go to the cervical plexus, and communicate especially with the anterior branches of the third and fourth cervical nerves. The second and third, on the contrary, send each a branch to it, which increases its volume in a sensible manner, after forming with it several anastomoses from which result triangular areolæ which contribute to the formation of the cervical plexus. It then exhausts itself by expanding in the upper part of the trapezius muscle into a more or less considerable number of filaments, one of which traverses that muscle, ascending behind it to a greater or less height.

OF THE HYPOGLOSSAL NERVES,[*] OR NERVES OF THE NINTH PAIR.

1650. The *Hypoglossal Nerves* arise by ten or twelve very slender filaments, before which passes the vertebral artery, from the grooves which separate the corpora pyramidalia and olivaria. These filaments, which are placed in the same line one above the other, and commence each by two or three roots, descend a little outwards, converging, presently unite into a single cord, sometimes into two, communicate frequently with each other, and issue from the skull by the anterior condyloid foramen, contained in a canal of the dura mater, immediately covered by the neurilemma, and enveloped in a sheath of the arachnoid membrane.

1651. As it leaves the condyloid foramen, the hypoglossal nerve is united to the outer side of the pneumogastric nerve by cellular tissue, and sometimes by a nervous filament. It then descends forwards and becomes more superficial, placed upon the two branches of the common carotid artery, the pneumo-gastric nerve, and the superior cervical ganglion, and covered by the stylo-hyoideus and digastricus muscles, the occipital artery, and the internal jugular vein. There, it communicates, by one or two filaments, with the nervous arch which the first cervical nerve and the sub-occipital nerve form around the transverse process of the atlas. It then appears between the branches of the internal jugular vein, and immediately under the sterno-cleido-mastoideus muscle.

Arrived at the angle of the jaw, it changes its direction; bends under the middle tendon of the digastric muscle, sends a considerable branch along the neck, and ascends itself forwards towards the tongue, where it terminates.

1652. *Descending Cervical Branch.* It arises at the place where the hypoglossal nerve forms a bend around the digastric muscle, and is sometimes strengthened at its commencement by a filament from the pneumo-gastric nerve. It descends vertically along the anterior side of the internal jugular vein as far as the middle of the neck, where it bends backwards and upwards to anastomose with the internal descending branch of the cervical plexus, under the sterno-cleido-mastoideus muscle, and over the common carotid artery and internal jugular vein. This anastomosis forms a reversed arch, from the convexity of which proceed several filaments which constitute in this place a small plexus more or less complicated.

From its commencement this branch furnishes no twig; but, immediately before communicating with the cervical plexus, it gives off two anteriorly, which soon unite, to proceed under the omohyoideus muscle. There they separate again: one of them loses itself upon the inner surface of that muscle; the other traverses it, gains the sterno-hyoideus, and divides in its substance as far as its inferior attachment, sending some filaments to the sterno-thyroideus muscle.

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[*] Υπό, sub; γλῶσσα, lingua.

The small plexus which terminates this branch gives off several sets of twigs. The *internal*, to the number of two, glide under the omo-hyoideus muscle, and throw themselves into the sterno-thyroideus, where they divide into the ascending and descending filaments. The *external*, which are also two in number, descend under the omo-hyoideus, and are lost in its scapular extremity. The *inferior*, which are more slender, and of which there are two or three, proceed along the common carotid artery, furnish some filaments to its walls, and then go to communicate with the third and fourth cervical nerves, and frequently with the diaphragmatic nerve.

1653. *Lingual Branch.* This is the true continuation of the trunk. It enters at first between the mylo-hyoideus and hyo-glossus muscles, increases considerably in volume by the separation of its fibres, gives off a pretty large twig to the thyro-hyoideus muscle, receives one from the superior cervical ganglion, and sends some filaments to the constrictor pharyngis superior, stylo-pharyngeus, genio-hyoideus, mylo-hyoideus and genio-glossus. In the two last muscles there is observed a union between one of the filaments of the hypoglossal nerve and the mylo-hyoid filaments of the inferior dentar nerve (1599). Several of these filaments ascend upon the outer surface of the hyo-glossus muscle, form there a kind of plexus by their frequent anastomoses, and all communicate with filaments of the lingual branch of the inferior maxillary nerve (1598).

Arrived at the anterior edge of the hyo-glossus muscle. This branch dives, along with the lingual artery, between the genio-glossus and lingualis muscles, and directs itself inwards, forwards, and upwards. It then terminates, at about an inch from the point of the tongue, by a great number of filaments which are not distributed to the papillæ of its mucous membrane, but lose themselves in the fleshy fibres of the muscles of this region, where they communicate frequently with each other.

OF THE SUB-OCCIPITAL NERVES, OR FIRST PAIR OF CERVICAL NERVES OF MANY AUTHORS.

1654. The *Sub-occipital Nerve* arises upon the sides of the spinal marrow, immediately under the medulla oblongata, by seven or eight filaments united into two or three bundles before the ligamentum dentatum. Sometimes two or three other filaments, issuing from the spinal marrow behind that ligament, form a separate root for it, a little inferior to the other. The spinal accessory nerve sometimes passes between these two origins; but most commonly it is placed behind the posterior and communicates with the anterior (1646).

The two roots of the nerve converge and proceed outwards and backwards. The anterior receives a filament from the first cervical nerve. They traverse the fibrous canal by which the vetebral artery enters the skull in the reverse direction of that vessel, and place themselves between it and the groove of the posterior arch of the atlas, connected with these parts by a pretty dense cellular tissue. There, they unite, and form a very elongated ganglion, from which emanate two branches, an anterior and a posterior.

1655. *Anterior Branch.* Long and slender, and of smaller size than the posterior, this branch turns at first from within outwards, then from behind forwards, over the outer edge of the vertebral artery, passes above the transverse process of the atlas, and soon appears between the rectus capitis anticus minor and rectus capitis lateralis muscles. It then changes its direction, descends before the transverse process, and terminates by anastomosing with a filament of the first cervical nerve, so as to embrace that process by a kind of arch.

This branch gives off successively in its course, 1st, one or two filaments to the rectus capitis lateralis, and rectus capitis anticus minor; 2dly, a very slender filament which accompanies the vertebral artery as far as the basilar trunk, and which is sometimes wanting; 3dly, another more constant filament, longer and equally slender, which descends to the inner part of the canal which lodges that vessel along the cervical column, and which there anastomoses with an ascending filament of the inferior cervical ganglion, and with the trunk of the first cervical pair at its passage between the atlas and axis; 4thly, a twig to the upper part of the rectus capitis anticus major. From the arch which it forms with the first cervical nerve, arise several other small filaments, which communicate with the pneumo-gastric and hypoglossal nerves (1651,) and with the superior cervical ganglions.

1656. *Posterior Branch.* Thicker and shorter than the other, it ascends a little backwards through the adipose cellular tissue, which fills the triangular space comprised between the obliquus capitis inferior and superior, and the rectus capitis posticus major muscles, and, after running a course of four or five lines, divides into three twigs which separate from each other in a radiating manner. The first, or *superior* and *internal*, directs itself transversely inwards, between the complexus major and rectus capitis posticus major, in which muscles it loses itself as well as in the rectus posticus minor. The second, or *superior* and *external*, ascends outwards, and is distributed to the obliquus capitis superior. It is sometimes double or triple, so that, in proportion to its size, this muscle receives a great quantity of nervous filaments. The third or *inferior* twig descends towards the middle part of the upper edge of the obliquus major, and subdivides into several filaments, some of which lose themselves in that muscle, while the others, which are often very slender, and most commonly two in number, anastomose in their course, forming a kind of nervous arch, with the posterior branch of the first cervical nerve. One of these latter passes behind the muscle, and the other traverses it, to throw itself into the middle part of the complexus major. They vary much in respect to size.

In some subjects, in place of these three twigs, the branch immediately divides into seven or eight filaments which proceed directly to their destination.

OF THE NERVES WHICH PASS THROUGH THE INTERVERTEBRAL FORAMINA OF THE VERTEBRAL COLUMN AND THROUGH THE SACRAL FORAMINA.

1657. These nerves, of which there are thirty pairs, seven for the cervical region, twelve for the dorsal, five for the lumbar, and six for the sacral, all agree in possessing the following characters: 1st, they rise from the sides of the spinal marrow by means of two roots, an interior and smaller, and a posterior or larger, between which passes the ligamentum dentatum ; 2dly, each of these roots is formed by a greater or less number of distinct filaments, separated from each other at their commencement ; 3dly, before issuing from the vertebral canal, they traverse a certain space in its interior ; 4thly, in their passage through the intervertebral holes, they unite ; 5thly, but previous to this, the posterior root alone forms a particular enlargement or a kind of ganglion of a grayish colour and oval form, hard, and of a texture difficult to be determined, which is lodged in a cavity furnished by the bony surfaces.

OF THE CERVICAL NERVES.

1658. The first of these nerves passes between the atlas and axis ; the last between the seventh cervical vertebra and the first dorsal. They are distinguished by their numerical names, counting from above downwards. Their anterior roots commonly arise from the spinal marrow by two bundles formed of seven or eight filaments, isolated at their very commencement, but uniting almost immediately, and proceeding from above downwards gradually increasing in size. The posterior roots, which are much larger, arise by a variable number of fibres (three or four for the first, six or seven for the next three, eight or nine for the last) in a pretty distinct groove of the spinal marrow (1447.) Each of these bundles is composed of several isolated filaments, less distinct than those of the anterior roots, and which converge towards each other, so as to give to the root a pyramidal form. It is also pretty frequently remarked, that between two of these roots there exists a middle filament, which bifurcates in such a manner as to belong equally to both.

The first two pairs of cervical nerves proceed nearly in a transverse direction within the vertebral canal; the rest descend so much the more obliquely towards the hole by which they are to emerge the lower they are situated, so that between the origin and exit of the last there is an interval of the height of a vertebra.

In the intervertebral holes, the two roots, which are very close to each other, are separated by a thin partition which seems to divide into two the fibrous canal of the dura mater (1494,) and only unite beyond the ganglion formed by the posterior. They then give rise to the trunk of the nerve itself, which, after a very short course, separates into two branches, a *posterior* and an *anterior*.

OF THE FIRST PAIR OF CERVICAL NERVES.

1659. *Posterior Branch.* This branch is larger than the anterior, which is the reverse of what is observed in the other cervical nerves. It is reflected from beneath upwards under the lower edge of the obliquus capitis inferior, ascends between it and the complexus major, proceeds inwards, traverses the last mentioned muscle, becomes sub-cutaneous and divides into several twigs upon the occipital bone. At its commencement, it communicates upwards with the sub-occipital nerve (1656,) and downwards with the corresponding branch of the second cervical nerve (1661.) It also gives a filament to the highest part of the levator anguli scapulæ. At the moment of this reflection, it sends before the complexus major numerous filaments which descend into its substance and are there lost, or which, passing under its inner edge, gain its posterior surface, and are there distributed as well as in the complexus minor and splenius, and sometimes in the trapezius and sterno-cleido-mastoideus. Lastly, it terminates at the back part of the head, by twigs which are expanded in the occipital muscle and integuments, or anastomose with the filaments of the frontal, sub-occipital (1656) and posterior auricular (1608) nerves, and with those of the cervical plexus (1673.)

1660. *Anterior Branch.* It separates from the preceding nearly at a right angle. It turns over the lateral articulation of the atlas and axis, between the transverse processes of these vertebræ. There it is covered by the levator anguli scapulæ, splenius and first intertransversalis colli, and immediately after divides into several twigs. One of these ascends upon the atlas to form a nervous arch with a filament of the sub-occipital nerve (1655;) another divides into several filaments which go to the superior cervical ganglion; a third loses itself in the rectus capitis anticus major; a fourth enters into the formation of the cervical plexus, uniting by two or three anastomoses with the anterior branch of the second cervical nerve; a fifth, which is very small and very high, anastomoses with the pneumo-gastric nerve.

OF THE SECOND PAIR OF CERVICAL NERVES.

1661. *Posterior Branch.* Half the size of the anterior, this branch turns over the lateral articulation of the axis and third cervical vertebra, and in particular over the synovial capsule. It at first descends a little, then ascends before the complexus major, crossing the inferior twigs of the posterior branch of the first cervical nerve (1659,) perforates that muscle and the trapezius, and becomes subcutaneous towards the upper part of the neck. Its first filament ascends to unite with a filament of the preceding nerve. It furnishes another more considerable twig, which passes between the articular and transverse processes of the third vertebra, gives three or four filaments to the posterior recti and oblique of the head, throws one into each superior interspinalis muscle, glides under the edge of the complexus minor, splenius, transversalis colli and semispinalis colli muscles. While it terminates itself in the integuments of the back of the neck and occipital region, as well as in the trapezius muscle.

1662. *Anterior Branch.* It proceeds forwards and outwards, covered by the splenius and levator anguli scapulæ, communicates upwards with the anterior branch of the preceding nerve (1660,) downwards with that of the third cervical nerve, bifurcates, and thus concurs to form the cervical plexus. By its middle part, it receives a filament of the superior cervical ganglion, and another from its cord which descends towards the middle or inferior ganglion. It also gives some filaments to the rectus capitis anticus major and levator anguli scapulæ.

OF THE THIRD PAIR OF CERVICAL NERVES.

1663. *Posterior Branch.* Smaller than that of the second pair (1661,) it is lodged in a groove formed between the articular processes of the third and fourth vertebræ, passes between the insertions of the complexus major and semi-spinalis colli, descends for some time between them, gives them some filaments, traverses the splenius and trapezius muscles, and loses itself in the integuments. It communicates with the preceding nerve by a small filament, and also sends some ramifications to the complexus minor, transversalis colli, and levator anguli scapulæ.

1664. *Anterior Branch.* Directed at first outwards, then turning over the fourth vertebra, it communicates with the superior cervical ganglion and the second and fourth pairs of cervical nerves, and contributes to the formation of the cervical plexus.

OF THE CERVICAL PLEXUS.

1665. Each of the anterior branches of the first, second, and third pairs of cervical nerves, after receiving a filament from the superior cervical ganglion, bifurcates and unites with the following and the preceding by two twigs, forming an arch from the convexity of which proceeds others which again unite more externally. It is of these anastomoses, which vary greatly in different subjects, that the *Cervical Plexus* is formed. It lies upon the scalenus posticus muscle, externally of the pneumo-gastric nerve, carotid artery, and jugular vein, under the posterior edge of the sterno-cleido-mastoideus, opposite the second, third, and fourth vertebræ. Immersed in a great quantity of adipose cellular tissue, intermingled with vessels, containing in its meshes many lymphatic ganglia, it communicates above with the sub-occipital nerve, below with the brachial plexus, and internally with the superior and middle cervical ganglia by several filaments. It also sends one or two filaments to the spinal accessory nerve (1649), furnishes some to the muscles on which it is applied, and gives off various branches which are distinguished into internal and external, ascending and superficial cervical.

1666. *Internal Descending Branch.* It is formed by two distinct filaments, manifestly supplied by the anterior branches of the first two cervical nerves, which unite into a single cord. It descends inwards under the sterno-cleido-mastoideus, and at the middle of the neck anastomoses, by a reversed arch, with the cervical branch of the hypoglossal nerve (1652).

1667. *Phrenic* or *Diaphragmatic Branch.* It terminates the cervical plexus inferiorly, and receives its principal filament from the anterior branch of the third cervical nerve. Most commonly these are joined with a very slender branch which comes from the second, and two or three which escape from the brachial plexus and only joins it at the lower part of the neck or even in the thorax. Sometimes its volume is augmented by a twig of the descending branch of the hypoglossal nerve or of the plexus which terminates it, and by a filament of the superior cervical ganglion.

Thus formed in a more or less variable manner, which it is difficult to describe with precision in the inextricable interlacement which the plexus forms, the diaphragmatic nerve descends along the fore and lateral part of the neck, between the rectus capitis anticus major and scalenus anticus, then over the anterior edge of the latter, giving off some delicate filaments to them. At the lower part of the neck, it communicates with the inferior cervical ganglion by one or two other filaments, then penetrates into the thorax between the subclavian artery which is behind, and the subclavian vein which is before, and proceeding inwards, forwards and downwards, crosses the internal mammary artery and enters the anterior mediastinum. There it sends ramifications to the thymus. It then passes over the trunks of the pulmonary vessels, and gliding before the root of the lung, descends as far as the diaphragm between the pleura and the lateral parts of the pericardium, to which it is closely attached, without however supplying any filament either to it or to the lung.

The phrenic nerve of the right side, which is more vertical, and placed more anteriorly than the left, divides before entering the diaphragm, into six or seven filaments which separate from each other and communicate frequently together. They first spread out ramifications upon the upper surface of the muscle; then the inner filaments, closely connected with the vena cava inferior, arrive by the aperture which gives passage to that vessel, at its inferior surface, to which they are partly distributed, partly also losing themselves in the cœliac plexus. The other filaments, which are longer and directed forwards, backwards and inwards, perforate the aponeurosis of the diaphragm, accompanying the diaphragmatic arteries and veins, and send several filaments to anastomose with the cœliac plexus and the stomachic filaments of the pneumo-gastric nerve.

The left phrenic nerve, which is posterior to the preceding, turning over the apex of the heart, and consequently longer also than it, furnishes ramifications to the convex surface of the diaphragm, perforates it, after being divided into several filaments, is partly expanded over its concave surface, partly over the œsophagus, and gives anastomosing filaments to the solar and cœliac plexus. It also furnishes filaments to the crura of the diaphragm and to the renal capsules, and sends some to anastomose with those of the opposite nerve.

It is not uncommon to see the terminating twigs of the diaphragmatic nerves presenting more or less numerous enlargements resembling ganglia.

1668. *External descending branches.* These are four or five in number, sometimes only two, but always furnishing to the same parts an equal quantity of twigs. They arise principally from the third cervical nerve, and but slightly from the second. Their course is very short, and they divide almost directly, and with numerous variations, into a great number of twigs, which are distinguished according to their position.

1669. *Supra-clavicular Twigs.* They descend along the lateral part of the neck, under the platysma myoides, and divide into a great number of very long filaments, some of which pass before the middle part of the clavicle and inferior extremity of the sterno-cleido-mastoideus, to be distributed upon the pectoralis major, in the integuments of the thorax and to the mammæ, while the others, directing themselves more outwards and backwards, are placed between the deltoides and pectoralis major muscles, and ramify in the skin of the top of the shoulder and outer and upper part of the arm.

1670 *Supra-acromian Twigs.* They proceed along the upper edge of the trapezius muscle, send to it some filaments which anastomose in its substance with those of the termination of the spinal nerve (1649,) then, on arriving at the acromion, subdivide, and cover the outer and back part of the deltoid muscle with a great quantity of ramifications

1671. *Sub-clavicular Twigs.* They are deeply imbedded in cellular tissue, in the triangular space which exists between the clavicle and the trapezius and sterno-cleido-mastoideus muscles. Arrived beneath the clavicle, they distribute themselves to the scapular extremity of the omo-hyoideus muscle, and to the upper part of the subscapularis and serratus magnus, and lose themselves in the arm-pits.

1672. *Deep Cervical Twigs.* These descend backwards along with the spinal accessory nerve, with which they communicate more or less frequently, and are distributed to the trapezius, levator anguli scapulæ and rhomboideus muscles, as well as to the neighbouring cellular tissue and lymphatic ganglia.

1672. *Mastoid Branch.* This is one of the two ascending branches of the cervical plexus. It ascends along the posterior edge of the sterno-cleido-mastoideus, between the integuments and the splenius muscle, and on arriving at the mastoid process, divides into several filaments which are distributed to the integuments of the posterior and lateral part of the head, to the inner surface of the pavilion of the ear, and to the occipitalis muscle. They anastomose with the auricular twig of the facial nerve (1608), and with the posterior branch of the second cervical nerve (1661.)

1674. *Auricular Branch.* This is the second ascending branch of the plexus, and is nearly twice the size of the mastoid branch, before which it is situated. It is directed outwards at the moment when it arises from the plexus, is soon reflected over the posterior edge of the sterno-cleido-mastoideus, and, after forming a kind of arch, proceeds obliquely upwards and forwards between the outer surface of that muscle and the integuments. When it has arrived upon its anterior edge opposite the angle of the jaw, it divides into several twigs whose number varies in different subjects. The *anterior*, ascending upon the outer surface of the parotid gland, give it numerous filaments, among which there is one that goes to anastomose deeply with the inferior branch of the facial nerve (1618), and gain the lower part of the pavilion of the ear. There they expand and ramify upon its two surfaces, being especially distributed to the integuments. Some of their filaments, which are larger than the rest, follow the contour of the helix, after traversing the substance of the pavilion from within outwards and from beneath upwards, between the lobule and the end of the fibro-cartilage. They anastomose with the superficial temporal nerve of the inferior maxillary (1599). The *posterior twigs*, of which there are one or two, run along the posterior edge of the sterno-cleido-mastoideus, and divide upon the mastoid process into filaments which gain the inner surface of the pavilion of the ear, the upper part of the external auditory canal, and the integuments of the lateral part of the head, where they anastomose with the ramifications of the preceding branch.

1675. *Superficial Cervical Branches.* There are generally two, of which one is larger; but it is not uncommon to find only one, which sometimes comes from a common trunk with the auricular. Arising from the middle part of the plexus, and especially from the second cervical nerve, they are reflected, like the preceding and beneath it, over the posterior edge of the sterno-cleido-mastoideus muscle, from whence they proceed transversely between it and the platysma myoides. They immediately divide into a greater or less number of twigs and filaments, some of which ascend to unite deeply with the descending branch of the facial nerve (1618) and with some filaments of the auricular branch of the same plexus (1674), while the others diverge in all directions, and are distributed to the platysma myoides and digastricus muscles, the integuments of the neck and the maxillary gland, where they communicate with the filaments of the mylo-hyoid twig of the inferior maxillary nerve (1598), and with those of the facial nerve. Some of them proceed transversely to anastomose in the median line with the ramifications of the opposite side. Some others ascend superficially towards the lower parts of the face to be united to the mental nerve (1598).

OF THE FOURTH, FIFTH, SIXTH, AND SEVENTH PAIRS OF CERVICAL NERVES.

1676. *Posterior Branches.* They are much smaller than the corresponding branches of the first three pairs. They descend obliquely outwards between the semi-spinalis colli and complexus major muscles, to which they give filaments, and on arriving at the spinous processes, traverse the splenius and trapezius, and lose themselves in their fibres and in the integuments of the back part of the neck and upper part of the back.

1677. *Anterior Branches.* They are remarkable for their size. At first situated between the two scaleni muscles, before the posterior, they all furnish one or two filaments, which anastomose with those of the cervical ganglia, and some others which lose themselves in the scaleni muscles. They then all communicate together, and form the *Brachial Plexus.* It is moreover to be observed here, that the anterior branch of the fourth nerve sends a twig to the phrenic nerve (1667) and communicates with that of the third, while that of the seventh unites with a branch of the first dorsal nerve.

OF THE BRACHIAL PLEXUS.

1678. Formed by the union and interlacement of the anterior branches of the last four cervical nerves and first dorsal, broad above and below, and contracted in the middle, the brachial plexus extends from the lateral and inferior part of the neck to the axilla, where it divides into several branches which are distributed to the arm. In forming it, the anterior branches of the above-mentioned nerves proceed in the following manner. Those of the fourth and fifth cervical nerves descend obliquely outwards, and, after a course of about an inch and a half, unite into a single trunk which preserves the same direction. Those of the seventh cervical and first dorsal nerves also unite and form a trunk which becomes nearly horizontal. Lastly, that of the sixth cervical nerve proceeds for a long time between these two trunks in an isolated manner; but, opposite the first rib, it unites to both. Thus, the brachial plexus divided into three distinct portions at the moment of its origin, afterwards forms a large flat bundle in which the nervous filaments are mingled and interlaced in an inextricable manner.

1679. The brachial plexus is situated at its commencement between the scaleni muscles, the anticus lying upon it so as to cover it below over a considerable extent, and leaving it almost bare above. It is then immersed in the subclavicular adipose tissue, passes between the subclavius muscle and the first rib, is applied upon the upper portion of the serratus magnus, and is lodged in the upper part of the axilla. Until it reaches the latter place it remains situated behind the axillary artery and vein, but then the different branches which terminate it, surround the artery on all sides and form a sort of sheath for it, while the vein, which had always been more superficial retains its position.

1680. The branches which the brachial plexus furnishes are distinguished into thoracic, supra-scapular, infra-scapular, and brachial. The latter are designated by the names of internal cutaneous brachial, external cutaneous brachial, median, radial, cubital, and axillary.

THORACIC BRANCHES.

1681. *Anterior Thoracic Branch.* Furnished chiefly by the sixth cervical nerve, it issues from the anterior part of the plexus, descends behind the clavicle before the axillary artery, and divides into a pretty considerable number of filaments. Some of these, which are not always met with, form a kind of ring by turning from before backwards around the axillary artery, and ascend, posteriorly to it, to unite a second time with the plexus towards the point where the seventh cervical nerve unites with the first dorsal. The others continue to descend upon the thorax, and are distributed among the fibres of the pectoralis major, and upon the inner surface of the pectoralis minor.

Frequently a small twig proceeds by itself from the cord which the last cervical and first dorsal nerves form, passes under the axillary artery, and is entirely distributed to the pectoralis minor.

1682. *Posterior Thoracic Branch.* It detaches itself from the upper part of the plexus posteriorly, and arises by two twigs, of which one comes from the fourth, the other from the fifth cervical nerve. Sometimes also the sixth cervical nerve furnishes it with one. That of the fourth sends a filament to lose itself in the scalenus posticus and levator anguli scapulæ. Then, united into a single trunk, they pass behind the axillary vessels, and descend upon the sides of the thorax, adhering to the serratus magnus, in the lower third of which they are exhausted by a great number of ramifications, without having previously given off any filaments.

SUPRA-SCAPULAR BRANCH.

1683. Issuing from the upper and posterior part of the brachial plexus, and furnished especially by the fourth cervical nerve, it descends obliquely backwards toward the upper edge of the scapula, passes under the ligament which closes the coracoid notch (649,) previously gives a filament to the subscapularis muscle, then obliquely traverses the outer region of the fossa supra-spinata, and furnishes several filaments to the supra-spinatus muscle, under which it is situated. It then passes into the fossa infra-spinata, at the fore part of the spine of the scapula, towards the base of the acromion process, and divides into three or four twigs which descend and are subdivided in the infra-spinatus and teres minor muscles.

INFRA-SCAPULAR BRANCHES.

1684. They arise at variable points of the brachial plexus, and sometimes from the axillary nerve, which itself comes off from it, either separately or by a common trunk. Their number is as subject to variation as their origin; but in general there are three of them.

The *first*, which is the largest, comes from the posterior part of the plexus, and passes behind the axillary vessels to descend between the serratus magnus and subscapularis, traverse the teres major, and lose itself by two or three twigs on the anterior surface of the latissimus dorsi.

The *second*, which is the smallest of the three, also issues from the plexus behind, throws itself upon the inner surface of the subscapularis muscle, and is distributed to it.

The *third* has sometimes a common origin with the first, and also frequently comes from the axillary nerve. It descends obliquely along the subscapularis muscle, and ramifies in its substance as well as in the teres major and teres minor.

OF THE INTERNAL CUTANEOUS BRACHIAL NERVE.

1685. It is the smallest of the six branches which terminate the brachial plexus, from the inner and lower part of which it comes, being furnished almost exclusively by the first dorsal nerve and the last cervical. It descends vertically under the brachial aponeurosis, along the inner surface of the arm, near the basilic vein, which is sometimes placed before, sometimes behind it, and sometimes on its sides. At first deeply concealed in the cellular tissue of the axilla, between the median and ulnar nerves, it becomes more superficial as it descends; but it only gives off some very slender filaments which lose themselves in the cellular tissue and skin, and of which one directs itself towards the inner condyle. It is near this tuberosity, and sometimes sooner, that the trunk of the nerve itself divides into two branches, an external, and an internal.

1686. *External Branch.* Smaller than the other, it runs along the edge of the biceps muscle, almost immediately pierces the brachial aponeurosis, and directs itself obliquely downwards and forwards, placed above the median nerve, which it accompanies as far as the lower part of the biceps muscle. Then traversing the middle of the bend of the arm, it remains on the surface of the aponeurosis of the fore-arm until near the wrist, where it terminates by twigs which are distributed to the integuments, and which cannot be traced beyond the annular ligament of the wrist (1252.) In passing over the fore-arm, it gives off on either side filaments which may be distinguished into *radial* and *ulnar*, and which proceed obliquely downwards, and are distributed to the integuments of this part of the upper extremity, anastomising on the one hand with the twigs of the external cutaneous brachial nerve, and on the other, with those of the internal branch of the internal cutaneous nerve itself (1687).

1687. *Internal Branch.* This may be regarded as the continuation of the trunk. It continues to descend upon the brachialis internus muscle and accompanied by the basilic vein. Near the inner condyle, that is to say, after a short course, it divides into two twigs. Of these, the *anterior* directs itself obliquely over the anterior muscles of the fore-arm, passing sometimes behind sometimes before the median-basilic vein, and then furnishes, especially by its inner side, several filaments which descend very far behind the fore-arm and ramify in its integuments. Some of them extend as far as the inner edge of the hand. The *posterior* turns backwards under the condyle, descends along the ulna, and terminates by a great number of filaments which may be followed in the integuments as far as the back of the hand and to near the little finger.

OF THE EXTERNAL CUTANEOUS BRACHIAL NERVE.

1688. A little larger than the preceding, but smaller than the other brachial nerves, it arises from the outer part of the plexus and comes in particular from the fourth and fifth cervical nerves;

which, after forming a single trunk as far as the common origin of the biceps and coraco-brachialis, divide anew into two divergent cords, of which the inner passes before the axillary artery to contribute to the formation of the median nerve, while the outer constitutes the nerve of which we here speak.

1689. This nerve descends at first obliquely outwards behind the coraco-brachialis muscle, and passes into an aperture which its fibres leave for it, so that it passes through the muscle (1143), after supplying it with a very slender filament which may be traced until near its insertion into the humerus. After this, it descends along the inner and fore part of the arm, between the brachialis internus and biceps muscles, giving off several twigs to them. One of these twigs, which is larger than the others, descends inwards, divides into two filaments, and proceeds as far as the lower extremity of the brachialis internus. Another follows the same direction, and communicates with the median nerve towards the lower part of the arm. The external cutaneous nerve then disengages itself opposite the tendon of the biceps and externally of it, traverses the middle of the bend of the arm under the median-cephalic vein, and descends along the fore and outer part of the fore-arm, between the aponeurosis and the skin. When it has arrived at some distance from the wrist, a place where its volume is sensibly diminished on account of the numerous filaments which it has furnished to the integuments during its course, it divides into two branches, an outer and an inner, and so terminates.

1690. The *outer branch*, which is larger than the other, sends a twig over the back of the hand, which is more or less prolonged upon the fingers. It then descends behind the thumb and upon its outer side, also giving some filaments to the fore-finger. Several of its ramifications anastomose with those of the radial nerve.

1691. The *inner branch* descends upon the muscles of the thumb, in the palm of the hand, and there subdivides into a multitude of filaments which may be traced upon the fingers.

OF THE MEDIAN NERVE.

1692. This is the largest nerve of the brachial plexus, from which it arises, behind the internal cutaneous brachial nerve, and between the ulnar and external cutaneous nerves. The sixth and seventh cervical nerves, united to the first dorsal, form its principal origin, to which is joined a branch of the common trunk of the fourth and fifth cervical nerves (1688), which forms, with all the other roots, a kind of nervous interlacement around the axillary artery (1679).

1693. After thus originating, the median nerve descends a little outwards behind the inner part of the biceps and internally of the brachial artery. It arrives at the bend of the arm without giving off any ramification, and traverses it in its middle part, internally of the biceps and under the median vein. It then sinks behind the anti-brachial aponeurosis, between the brachialis internus and pronator teres, passes between the two origins of the latter muscle (1168) and proceeds along the fore-arm between the flexor digitorum sublimis, and flexor profundus, between whose tendons it becomes apparent below. Lastly, it passes along with them under the anterior annular ligament of the carpus, adheres to them by a very delicate membranous cellular tissue, becomes broader and thicker than it was before, and on arriving in the palm of the hand towards the upper part of the metacarpal bones, divides into several twigs, which are distributed to the fingers, and which are distinguished numerically, counting from without inwards.

1694. As it proceeds between the brachialis internus and pronator teres, the median nerve gives off its first twigs in indeterminate number, fasciculate, and destined for the pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris, flexores digitorum sublimis and profundus, and flexor longus pollicis. They penetrate by the inner surface of most of these muscles, and are lost in their fleshy fibres.

1695. *Interosseous Twig.* Larger than the preceding, and arising under them, this twig separates from the median nerve at a very acute angle, and gives off at its origin a filament which goes to the flexor sublimis, in which it loses itself. The interosseous nerve then passes between the two flexor muscles of the fingers, gains the anterior surface of the interosseous ligament, accompanying the artery of this name, and gives off laterally several filaments which are destined for the flexor digitorum profundus and flexor longus pollicis. Arrived at the upper edge of the pronator quadratus, it dives under it giving it some filaments, and then emerges by the inferior aperture of the interosseous ligament (667) to be expanded over the back of the hand, where it furnishes a great number of ramifications which become superficial, but which do not extend so far as those of the interosseous artery which they accompany.

1696. Pretty frequently, after giving rise to the interosseous twig, the median nerve furnishes another which descends inwards, follows the course of the ulnar artery, and anastomoses with the ulnar nerve. It then sends some irregular filaments to the flexors of the fingers and flexor carpi radialis. But, at the lower part of the fore-arm, there separates from it the *cutaneous palmar twig*, which is of considerable size, issues between the tendons of the flexor sublimis, and loses itself in the integuments of the palm of the hand, after a short course.

1697. *First Digital Twig.* Directed obliquely outwards, it immediately gives off several filaments to the abductor, opponens and flexor brevis pollicis, descends along the latter, to which it gives off a ramification, and following the radial edge of the thumb, arrives at its extremity. Opposite the first phalanx, it throws backwards into the integuments of the posterior surface of the thumb, a filament which also ascends outwards. Frequently also the first filaments which escape from it to be distributed among the muscles of the ball of the thumb, form an entirely distinct twig.[1]

1698. *Second Digital Twig.* It follows at first the direction of the preceding twig; but separates from it as it descends, to proceed over the ulnar edge of the first bone of the metacarpus and of the thumb, giving a filament to the flexor brevis, and several other ramifications to the integuments of that finger.

1699. *Third Digital Twig.* Placed upon the first of the lumbricales muscles, it furnishes it at first with a filament, then descends along the radial edge of the second metacarpal bone and fore-finger to the extremity of the latter, where, after giving off one or two posterior filaments, it expands and anastomoses with one of the branches of the next twig.

1700. *Fourth Digital Twig.* Descending between the second and third metacarpal bones, it gives a filament to the second of the lumbricales muscles, and bifurcates opposite the separation of the inner and middle finger, and sometimes sooner. One of these secondary twigs follows the ulnar edge of the first, the other the radial edge of the second of these fingers. They both furnish filaments posteriorly to the integuments, opposite the first phalanges, and are expanded upon the summits of the fingers.

1701. *Fifth Digital Twig.* It follows the original direction of the median nerve, in the interval of the third and fourth metacarpal bones. After giving a filament to the third lumbricalis, it divides into two secondary twigs which descend upon the ulnar edge of the middle finger and radial edge of the ring finger. The latter receives a filament of the ulnar nerve; but both send posterior filaments into the integuments of these fingers, and terminate by anastomosing in their pulp.

1702. All the digital twigs furnished by the median nerve accompany the collateral arteries of the fingers, and give off on all sides very slender filaments to the cellular tissue and skin.

OF THE ULNAR OR CUBITAL NERVE.

1703. Arising from the inner and back part of the brachial plexus, and in particular from the last two branches which enter into its formation, this nerve descends almost vertically, only inclining a little backwards, along the inner edge of the triceps extensor muscle, to which it is pretty closely attached by cellular tissue. Not far from the elbow, it gives off some long and slender filaments which go to the integuments of the upper and back part of the fore-arm. It then passes between the inner condyle and olecranon, traverses the upper extremity of the flexor carpi ulnaris muscle, and directs itself obliquely downwards and forwards, along the anterior and inner part of the fore-arm, between the flexor carpi ulnaris and flexor digitorum profundus, and internally of the ulnar artery. Its volume gradually diminishes as it descends. Towards the lower region of the fore-arm, a little above the wrist, it divides into two branches, of which one proceeds over the back of the hand, while the other goes to the palm.

1704. Before dividing, and after passing through the substance of the flexor carpi ulnaris, the ulnar nerve commonly gives off from four to six filaments which are distributed to the neighbouring muscles, and especially to the flexor carpi ulnaris and flexor digitorum profundus. One of them accompanies the ulnar artery for a considerable time, and loses itself in the two flexors of the fingers near the wrist.

1705. *Palmar Branch.* Larger than the dorsal, and appearing to be the true continuation of the trunk, it emerges from behind the tendon of the flexor carpi ulnaris, proceeds along its outer edge, passes between the annular ligament and the integuments, beside the pisiform bone, and, before arriving at the palm of the hand, divides into two twigs, a deep and a superficial.

The *deep twig* passes behind the upper extremity of the opponens minimi digiti, dives behind the bundle formed by the tendons of the flexors of the fingers and lumbricales, and then bends outwards, so as to form a kind of arch, of which the concavity is above, and whose convexity furnishes same filaments. Of these, the two first are distributed to the muscles of the little finger, four or five others dive into the substance of the interossei muscles, and lose themselves towards the back of the hand, while those which terminate the twig are expanded in the adductor pollicis and abductor indicis muscles.

The *superficial twig* gives a filament to the muscles of the little finger beneath the pisiform bone, and presently divides into two secondary twigs, an outer and an inner. The *outer* is the larger. It descends vertically beneath the palmar aponeurosis, gives off a filament which anastomoses with the last digital twig of the median nerve (1701), furnishes another to the fourth lumbricalis, and bifurcates in such a manner that one of its ramifications descends along the inner side of the ring finger, and the other along the outer side of the little finger, being in other respects distributed precisely in the same manner as that of the median nerve. The *inner* directs itself obliquely inwards, gives at first filaments to the muscles of the internal palmar region, before which it passes, and gains the inner edge of the little finger, at the extremity of which it anastomoses by an arch with the preceding.

1706. *Dorsal Branch.* Much smaller than the palmar, and winding between the inferior part of the ulna and the tendon of the flexor carpi ulnaris, it gains the inner part of the back of the hand, where, after giving one or two filaments to the integuments, it separates into two twigs, an inner and an outer.

The *inner* descends along the inner edge of the fifth metacarpal bone, gives a great number of filaments to the abductor minimi digiti and the integuments, and loses itself on the dorsal surface of the little finger.

The *outer* passes between the fourth and fifth metacarpal bones, and divides at a greater or less height into two filaments, one of which descends backwards over the outer side of the little finger and the inner side of the ring finger, while the other is distributed on the outer side of the latter and the inner side of the middle finger. These ramifications distribute a great number of filaments to the skin of the back of the fingers, and anastomose at their extremities with themselves, or, on that of the middle finger with the radial nerve.

OF THE RADIAL NERVE.

1707. It arises from the inner and back part of the brachial plexus, where it is especially formed by the fifth, sixth and seventh cervical nerves, and first dorsal. Its volume equals that of the median nerve, and even sometimes exceeds it. It descends at first obliquely from before backwards between the two portions of the triceps extensor and the inner part of the humerus. It then turns from within outwards, and from above downwards in the groove which the outer surface of that bone presents (433); and lastly, on arriving at the anterior, external and inferior part of the arm, between the brachialis internus and supinator longus, it proceeds over the elbow-joint, and there divides into two branches, an anterior and posterior.

1708. But, before dividing, this nerve gives off a considerable number of twigs. Thus it gives two or three which separate from it opposite the tendon of the united latissimus dorsi and teres major, and which go to the triceps extensor muscle. Farther down, it sends several twigs into the same muscle. One of them traverses its inferior and external portion, and looses itself in the brachialis internus. Another descends under its large portion, ramifies there, and transmits a very long and very remarkable filament to the anconeus muscle. Still lower, the radial nerve gives off a pretty large branch to the integuments of the fore-arm. Sometimes it is double. It perforates the brachialis internus, emerges betweeen it and the supinator longus, and descends along the outer and back part of the fore-arm and hand as far as the thumb, giving a great number of filaments to the skin and cellular tissue. Lastly, as it passes between the brachialis internus and supinator longus, the radial nerve sends some filaments still to the latter and to the extensor carpi radialis longior.

1709. *Anterior Branch.* Smaller than the other, it descends along the anterior and outer part of the fore-arm, between the two supinator muscles, and externally of the radial artery. Towards the lower third of the fore-arm, it winds a little outwards, passes under the tendons of the supinator longus and extensor carpi radialis longior, and descends between the integuments and the tendons of the extensor ossis metacarpi and extensor primi internodii pollicis. Presently after, it divides into two twigs, an outer and smaller, and an inner and larger. The *outer* descends upon the dorsal surface of the thumb, and divides into two filaments, one of which ramifies along its inner edge, while the other bifurcates to be distributed to its inner side and to the outer side of the fore-finger. The *inner* proceeds over the back of the hand, and divides into two filaments, one of which belongs to the inner side of the fore-finger, the other to the outer side of the middle finger. All these filaments, before terminating at the extremities of the fingers, furnish many ramifications to the abductor and adductor indicis, interossei muscles, the integuments, and the parts about the first metacarpo-phalangeal articulations.

1710. *Posterior Branch.* It directs itself obliquely outwards, passes under the supinator longus and extensores carpi radiales muscles, gives off several filaments to them as well as to the anconeus, enters between the fleshy fibres of the supinator brevis, furnishes it with several filaments, passes through it in the longitudinal direction, winding obliquely downwards over the superior extremity of the radius, and arrives at the posterior surface of the fore-arm, divided into several twigs varying as to their number and origin. Some of these, the *posterior*, lose themselves by being more or less prolonged downwards, in the supinator brevis, extensor carpi ulnaris, and extensor muscles of the fingers and index. The *anterior* belong to the muscles of the deep and posterior layer of the fore-arm. One of them, which is larger and longer than the others, descends behind the interosseus ligament, gives some ramifications to the neighbouring muscles, passes over the wrist-joint under the posterior annular ligament of the carpus, and divides on the back of the hand into a great number of filaments which lose themselves in the interossei muscles and cellular tissue.

OF THE AXILLARY OR CIRCUMFLEX NERVE.

1711. Arising from the inner and back part of the brachial plexus, in certain subjects, it appears to be but a branch of the radial nerve, but in general, it is particularly produced by the last two cervical nerves and the first dorsal. Immediately after its origin it descends before the subscalpularis muscle, which receives a considerable twig from it, then dives between the two teretes muscles, turns from before backwards and from within outwards between the capsule of the shoulder-joint and the long portion of the triceps extensor, and at length gains the posterior edge of the inner surface of the deltoid muscle, after giving some filaments to the teres minor.

1712. Opposite the triceps extensor muscle, this nerve divides into two branches. The *upper*, which is shorter, sends a twig into the infra-spinatus, and then loses itself in the deltoid muscle, after running for some time upon its internal surface. The other, or *inferior*, entirely loses itself in the deltoid muscle, and terminates near its anterior edge and insertion into the humerus.

OF THE DORSAL NERVES, OR THOSE WHICH ISSUE BY THE INTERVERTEBRAL FORAMINA OF THE DORSAL REGION OF THE VERTEBRAL COLUMN.

1713. They arise, like the cervical nerves (1658), from the lateral parts of the spinal marrow, by two distinct roots, an anterior and smaller, and a posterior or larger, separated by the ligamentum dentatum, directed so much the more obliquely downwards the lower they are examined, and united into a single trunk beyond the intervertebral hole and a small gray and hard ganglion, formed by the posterior root. In a word, the greatest similarity exists between them and the cervical nerves. They are twelve in number on each side, and are distinguished by their numerical name, counting from above downwards. The first issues between the first two dorsal vertebræ, and the last between the twelfth dorsal and the first lumbar vertebra.

1714. On emerging from the intervertebral hole which belongs to it, each dorsal nerve, less voluminous than the last cervical and the lumbar nerves, immediately divides into two branches, a *posterior* or *dorsal*, and an *anterior* or *intercostal*, of which the latter is the larger.

POSTERIOR OR DORSAL BRANCHES.

1715. They are immediately directed backwards between the transverse processes of the dorsal vertebræ, under the semi-spinalis dorsi and multifidus spinæ, where they commonly divide into two orders of twigs. Of these, the *inner*, of which there are one or two for each branch, and which are rather slender, enter immediately into the semi-spinalis dorsi and multifidus spinæ muscles, pass obliquely through them, giving off several filaments to them, emerge between them and the longissimus dorsi, which also receives ramifications from them, perforate the muscles which lie above the latter, and, for the most part, lose themselves in the skin of the back, some of them however remaining in the trapezius and rhomboideus. The *outer*, which are larger, descend obliquely outwards beneath the semi-spinalis dorsi, multifidus spinæ and longissimus dorsi, emerge in the triangular spaces which the levatores costarum form above, and pass between the sacro-lumbalis and longissimus dorsi, to which they furnish filaments, They then expand into several ramifications which creep under the latissimus dorsi, trapezius, and rhomboideus, pass through them, and are ultimately distributed to the skin.

ANTERIOR BRANCHES.

1716. The first issues under the first rib, and the twelfth under the last rib. They have this in common, that each of them receives one or two filaments from each thoracic ganglion. They then proceed outwards under the pleura to the angle of the ribs, where they enter between the two planes of the intercostal muscles, after which they draw near the lower edge of the rib immediately above them, and follow its course, which gives them a different inclination (85). They also accompany in a more or less intimate manner the intercostal vessels, and in particular the artery of that name.

1717. *Anterior Branch of the First Dorsal Pair.* Immediately after its origin, and after its communication with the first thoracic ganglion, it furnishes a twig which proceeds obliquely downwards under the inferior surface of the first rib, runs along its inner edge, arrives near the sternum, perforates the intercostal muscles, and loses itself on the upper and fore part of the thorax, after giving several filaments to the muscles just named. With respect to the branch itself, it descends outwards before the neck of the rib, and unites with the seventh cervical nerve to assist in forming the brachial plexus (1678).

1718. *Anterior Branch of the Second Dorsal Pair.* It directs itself along the inner surface of the second rib, as far as the anterior edge of the serratus magnus, where it divides into two twigs, an *intercostal* properly so called, and a *brachial*, after sometimes furnishing a considerable filament which ramifies in the posterior part of the intercostal muscles.

The *intercostal twig* continues to run along the lower edge of the rib, gives filaments to the intercostal muscles, and, on arriving at the sternum, emerges between that bone and the external intercostal muscle, and is expanded by several twigs on the anterior part of the thorax and in the pectoralis major.

The *brachial twig* immediately perforates the external intercostal muscle, after giving it some small filaments, and descends obliquely outwards into the axilla, where it sometimes receives a filament of communication from the internal cutaneous brachial nerve (1685), which augments its size. It then descends along the inner and back part of the arm, sends several filaments to the integuments, and loses itself near the elbow by a great number of ramifications.

1719. *Anterior Branch of the Third Dorsal Pair.* It follows the lower edge of the third rib as far as its middle, gives some filaments to the posterior part of the intercostal muscles, and divides into two twigs. One of these, the *intercostal*, follows the same direction as the branch, gives off but few filaments, passes under the triangularis sterni, furnishes it with some ramifications, and is expanded near the sternum upon the anterior part of the thorax. The other, the *brachial* twig, gives some filaments to the intercostal muscles, perforates the external, descends in the lower part of the axilla, and loses itself on the inner part of the arm, less low than the brachial twig of the second pair. It is also less voluminous than it.

1720. *Anterior Branches of the Fourth, Fifth, Sixth, and Seventh Dorsal Pairs.* They run along the lower edge of the corresponding ribs, as far as its middle, where, after sending numerous and pretty long filaments into the intercostal muscles, they divide into two orders of twigs. The *inner* follow the original course of the branch, give ramifications to the intercostales and triangularis sterni, pass under the latter, and emerge by one or two filaments on the sides of the sternum, to be distributed to the pectoralis major, the mamma and the integuments. The *outer* perforate the external intercostal muscles and separate into filaments, one of which proceeds backwards into the integuments of the lateral parts of the thorax, while the other ramifies in the obliquus abdominis externus and the skin of the lower belly.

1721. *Anterior Branches of the Eighth, Ninth, Tenth, and Eleventh Dorsal Pairs.* They follow the same course as the last; but their division happens so much nearer the anterior extremity of each intercostal space the lower they are examined, because it always takes place at the same distance from the intervertebral hole, although the spaces are successively shortened. The *inner twigs* follow the lower edge of each of the ribs, and leave it passing over the insertions of the diaphragm (873), which receives no filaments from them, to pass into the walls of the abdomen, between the transversalis and obliquus internus muscles, into which they send some divisions. Then, arriving at the outer edge of the rectus muscle, they separate into *deep filaments* which penetrate its fibres by its posterior surface, and *superficial filaments* which lose themselves in the integuments of the anterior region of the abdomen. The *outer twigs* perforate the external intercostal muscles, and separate into filaments which, like those of the preceding branches, are distributed, on the one hand, in the integuments of the lateral parts of the thorax, and on the other, in the serratus magnus and obliquus externus, and in the integuments of the lower belly.

1722. *Anterior Branch of the Twelfth Dorsal Pair.* At the moment when it commences, it sends a filament of communication to the anterior branch of the first lumbar nerve. It then separates from the twelfth rib, directs itself outwards and downwards, passes behind the anterior lamina of the aponeurosis of the transversus abdominis muscle, and before the quadratus lumborum, gives some filaments to the latter as well as to the diaphragm, and divides into two twigs opposite the anterior extremity of the rib. One of these twigs passes between the two oblique muscles of the abdomen, gives then some ramifications, becomes superficial, and loses itself in the integuments descending as far as the iliac rest. The other insinuates itself between the obliquus internus and transversus muscles, gives them some filaments, and loses itself in the rectus and pyramidalis of the lower belly.

OF THE LUMBAR NERVES, OR THOSE WHICH ISSUE BY THE INTERVERTEBRAL FORAMINA OF THE LUMBAR PORTION OF THE VERTEBRAL COLUMN.

1723. Of these nerves there are five pairs. They are designated by their numerical names, counting from above downwards. The first issues between the first two vertebræ of the loins, and the fifth between the last vertebra and the sacrum. These nerves arise, very near each other, from the inferior bulging of the spinal marrow (1449). Like those of all the other vertebral nerves, their roots are formed of two bundles of filaments; but here these bundles are very broad, especially for the last three pairs. The filaments which constitute them are immediately enveloped by a neurilemma, and, although very near each other, they do not communicate together. They may therefore be traced separately for a long time, and they thus contribute to form a kind of cord expanded into many filaments, and which the older writers named the *Cauda equina.* These roots descend very obliquely in the vertebral canal, and this disposition is much more decided in the inferior pairs than in the superior. There results from it that the place of their exit is very distant from that of their origin. The posterior root of each of them bulges in the manner of a ganglion in the intervertebral foramen, and then unites with the anterior, to form a common trunk placed between the notches of the vertebræ, and presently divides into two branches, a posterior and an anterior.

OF THE FIRST LUMBAR NERVE.

1724. *Posterior Branch.* Larger than those of the other lumbar nerves, it is directed backwards between the transverse processes of the first two vertebræ of that region, gives some filaments internally to the multifidus spinæ muscle, perforates the inferior fleshy mass of the sacro-spinalis muscle (804), leaves several twigs for it, creeps under the united aponeuroses of the latissimus dorsi, obliquus abdominis internus and serratus posticus inferior, traverses these aponeuroses towards the iliac crest, and finally ramifies in the teguments of the upper part of the hip.

1725. *Anterior Branch.* It receives a communicating filament from the lumbar ganglia, and another filament from the twelfth dorsal pair (1722). It then proceeds forwards and inwards under the origins of the psoas magnus (809), sends a twig to the anterior branch of the second lumbar nerve (1727), and throws itself into the lumbar plexus.

OF THE SECOND LUMBAR NERVE.

1726. *Posterior Branch.* A little smaller than the preceding, it equally passes between the transverse processes, sends inwards twigs to the multifidus spinæ muscle, traverses the mass of the sacro-spinalis, gives it some filaments, creeps in the same manner under the lumbar aponeurosis, perforates it toward the iliac crest, and is expanded by a great number of subdivisions in the integuments of the upper and back part of the thigh.

1727. *Anterior Branch.* It communicates with the lumbar ganglia, the anterior branches of the first and second pairs of the lumbar region, and enters into the composition of the lumbo-abdominal plexus.

OF THE THIRD LUMBAR NERVE.

1728. *Posterior Branch.* Still smaller than that of the second, it is distributed precisely in the same manner, and also ramifies in the integuments of the upper and back part of the thigh.

1729. *Anterior Branch.* It communicates with those of the second and fourth lumbar nerves, and with the lumbar ganglia, contributing also to the formation of the lumbo-abdominal plexus.

OF THE FOURTH AND FIFTH LUMBAR NERVE.

1730. *Posterior Branches.* They are both very small, and lose themselves in the fleshy mass of the sacro-spinalis muscle, without going so far as the aponeurosis which covers it. They also send some filaments into the multifidus spinæ muscle.

1731. *Anterior Branches.* They communicate with each other, and with the lumbar ganglia. That of the fourth nerve receives a branch from the third, and that of the fifth terminates the lumbo-abdominal plexus, descending into the pelvis to throw itself into the sciatic plexus.

OF THE LUMBO-ABDOMINAL OR LUMBAR PLEXUS.

1732. Formed by the union of the anterior branches of the five lumbar nerves, which all send twigs to it, this plexus is situated on the lateral parts of the bodies of the second, third, and fourth lumbar vertebræ, before the base of their transverse processes, and behind the psoas magnus. It represents a kind of elongated cord, very narrow above, much broader below, where the nerves unite with each other farther from the vertebral column than above. It communicates above with the anterior branch of the twelfth dorsal nerve (1722), and below with the sacral plexus, by the anterior branch of the fifth lumbar nerve (1731). It is terminated inferiorly by three cords which are named the crural, obturator, and sacro-lumbar nerves, and it previously furnishes some branches which are named musculo-cutaneous and genito-crural.

OF THE MUSCULO-CUTANEOUS BRANCHES.

1733. They are commonly three in number; but they present a multitude of variations, whether in their disposition, or in their mode of origin. In general, they direct themselves outwards, under the peritoneum, towards the iliac crest, there penetrate into the muscles of the abdomen and become sub-cutaneous.

1734. *Superior* or *Ilio-scrotal Branch.* It evidently arises from the first lumbar nerve, traverses the upper part of the psoas magnus, and descends obliquely outwards upon the quadratus lumborum, as far as the posterior part of the iliac crest. There it is lodged in a groove which the transversus abdominis forms at its attachment to the crest, and sends some twigs to that muscle and the iliacus internus. Towards the anterior third of the iliac crest, it perforates the transversus muscle, is placed between it and the obliquus internus, furnishes them with some filaments, and divides into two twigs. Of those the *outer* is distributed to the lower part of the three broad muscles of the abdomen and loses itself in the integuments. The *inner* continues the original course of the branch, descends between the transversus and obliquus internus, as far as the anterior and superior spine, follows the crural arch as far as the inguinal ring, perforates the aponeurosis of the obliquus externus, and ramifies in the integuments of the fold of the groin, and of the pubic region, as well as in the scrotum in the male, and the labia pudendi in the female.

1735. *Middle Branch.* Arising equally from the first lumbar nerve, it traverses the psoas magnus, descends along its outer edge, directs itself outwards before the iliacus internus and under the peritoneum, perforates the transversus abdominis close upon the iliac crest, is placed between it and the obliquus internus, then enters the latter muscle and the obliquus externus, gives a great number of filaments to all these muscles, furnishes some also to the integuments, and sends one in particular along the crural arch, to the upper and outer part of the scrotum.

1736. *Inferior* or *Inguino-cutaneous Branch.* It commonly arises by two roots from the second lumbar nerve, and under the two preceding branches. After perforating the psoas magnus, it runs along its outer edge for some time, passes obliquely before the iliacus muscle, gains the superior and anterior spine of the iliac bone, and issues from the pelvis between it and the inferior. It then becomes a little thicker, is flattened, and divides into two twigs behind the crural aponeurosis. Of these twigs the one is external and smaller than the other. It immediately directs itself outwards toward the posterior and upper part of the thigh, in the integuments of which it spreads out a great number of filaments. The other is internal, and seems to be the continuation of the branch. After a short course, it perforates the crural aponeurosis, becomes subcutaneous, descends upon the fore and outer part of the thigh as far as the knee, and gives off many filaments to the integuments and cellular tissue.

OF THE GENITO-CRURAL BRANCH.

1737. It comes from the first lumbar nerve, descends at first vertically in the substance of the psoas magnus, receives from the second lumbar nerve a filament which increases its size, then issues from the psoas muscle, follows its anterior surface for some time, covered by the peritoneum, and, near the crural arch, divides into two twigs, an inner and an outer. The *inner*, which is larger, accompanies the spermatic cord, passes with it through the inguinal ring, and ramifies in the integuments of the scrotum, and upper and inner part of the thigh, the tissue of the dartos, and the envelopes of the testicle. The *outer* descends along with the crural vessels behind the crural arch, in the midst of the lymphatic ganglia and cellular tissue of the groin; and there expands into a great number of filaments, which become cutaneous, and reach as far as the middle of the thigh, where they sometimes anastomose with those of the crural nerve.

OF THE CRURAL NERVE.

1738. The *Crural Nerve* arises from the anterior branches of the first four lumbar nerves, and forms the outermost of three cords which terminate the plexus. At first situated under the psoas muscle, it separates from it opposite the fourth lumbar vertebra, proceeds outwards along its outer edge, before the iliacus muscle, gives them some filaments, which, before penetrating them, form a sort of net-work at their surface, and issues from the abdomen behind the crural arch, along with the crural artery, externally and inferiorly of which it is situated, and which it surrounds with a kind of plexus, more or less complex, and sometimes wanting.

1739. Immediately after issuing from the abdomen, the crural nerve divides into a variable number of twigs, but always of considerable size. Sometimes this division takes place before its entering under the crural arch; but they may always be distinguished into superficial and deep.

1740. *Superficial Twigs.* Less voluminous than the others, they vary in number from two to six; but the distribution of their filaments is constant and uniform. They creep for some time under the crural aponeurosis, and perforate it more or less high, to become subcutaneous. The holes through which they pass are very distinct. Presently after, they separate into a multitude of filaments, which expand upon the inner and fore part of the thigh, and are distributed to the integuments, and of which several descend as far as the upper part of the leg, accompanying the vena saphena.

1741. *External Deep Twigs.* They vary much in number and form; but, in general, they are always larger than the preceding. They descend outwards between the iliacus, sartorius and rectus femoris, and separate into filaments, which are distributed to the neighbouring muscles. Thus the inferior extremity of the iliacus muscle receives some of them; the sartorius is traversed by three or four, which, after giving off ramifications to it, lose themselves in the integuments; a thick twig penetrates into the rectus femoris, and before entering it separates into two filaments, an upper and a lower; three or four others throw themselves into the outer portion of the triceps extensor; a like number are distributed in its middle portion, and the tensor vaginæ femoris commonly receives another.

1742. *Internal Deep Twigs.* They are less numerous than the external, and are especially distributed to the inner portion of the triceps extensor and to the pectineus and sartorius muscles. One of them accompanies the crural artery, placed at first before it, and afterwards on its inner side. It separates from it below, to glide under the inner edge of the sartorius, to which it gives some filaments, and then descends to the knee, where it is expanded. But the largest of all these twigs is the one which is called the *Internal saphenus* or *Tibio-cutaneous Nerve*, which accompanies the vena saphena. It descends at first internally of the crural artery, receives a twig of the obturator nerve, passes under the sartorius muscle in the channel which the adductor magnus forms (1316,) gives several filaments to these muscles, emerges internally of the knee between the tendons of the adductor magnus and triceps extensor, sends small twigs to the integuments, then united to the inner vena saphena, ramifies like it, accompanying it in all its subdivisions, and descends as far the first toe, after furnishing many cutaneous filaments.

OF THE OBTURATOR NERVE.

1743. It comes principally from the second and third lumbar nerves, and sometimes from the fourth. Smaller than the crural nerve, it descends at first almost vertically between the inner edge of the psoas magnus and the body of the fifth lumbar vertebra. It then follows the lateral and superior part of the excavation of the pelvis, running a little below the line of the upper strait, (407), accompanied by the obturator artery and vein, and placed under the former and above the latter. On arriving at the upper part of the obturator foramen, it gives off a twig which loses itself in the two obturator muscles. It then passes through the foramen, and arrives at the upper and inner part of the thigh, concealed by the pectineus and adductor longus. There it divides into two branches, an anterior and a posterior. The *anterior* descends between the adductor brevis and adductor longus, and separates into two twigs, of which the *inner* gives filaments to the first of these muscles, and loses itself in the upper part of the gracilis, while the *outer* belongs entirely to the latter muscle. Both also give off cutaneous ramifications, and furnish one or two anastomoses to the inner saphenus nerve, (1742.) The *posterior* directs itself between the adductor brevis and adductor magnus, and loses itself in the latter after giving filaments to the obturator externus muscle.

OF THE SACRO-LUMBAR NERVE.

1744. This nerve is double the size of the crural, and is formed by the anterior branch of the fifth lumbar nerve, to which is united a large twig of the fourth. It descends into the pelvis before the sacrum, near the sacro-iliac symphysis, and unites with the sciatic plexus. In its course it furnishes a single branch, which is the glutæal.

1745. *Glutæal Nerve.* It derives some roots from the sciatic plexus, issues by the sciatic notch above the pyramidalis muscle, and divides into a multitude of twigs, some of which enter the glutæus minimus, and the others the glutæus medius. The latter frequently reach as far as the tensor vaginæ femoris, by curving forwards.

OF THE SACRAL NERVES, OR THOSE WHICH ISSUE FROM THE SACRAL CANAL.

1746. The sacral nerves are commonly six on each side, often five, and rarely four only. The first issues by the upper sacral holes, and the last by the notches which are observed at the upper part of the coccyx, or when there are only five, it escapes between that bone and the sacrum Their size diminishes successively, so that the last two are very slender.

1747. These nerves arise from the lower part of the bulging which terminates the spinal marrow, by a double cord of filaments, as is the case with the vertebral nerves in general. These different cords descend vertically in the vertebral and sacral canals, form with those of the last lumbar pairs, the bundle known by the name of *Cauda equina*, and in other respects are precisely similar to the other nerves which arise from the sides of the spinal marrow; only the gangliform thickenings of the posterior root, in place of occurring at the outer part of the hole from which they are transmitted, occupy the bony canal of the sacrum. The last three are even considerably distant from the inferior sacral holes, so that the common trunk which results from the union of the two roots, runs a certain course before entering them.

1748. The sacral nerves transmit, through the anterior holes of the sacrum, branches which diminish in volume from above downwards, while on the contrary the posterior branches increase to the fourth, and then diminish.

OF THE FIRST SACRAL NERVE.

1749. *Posterior Branch.* Very small and rather short, at its exit from the first posterior sacral hole, it communicates with that of the following nerve, then descends a little obliquely outwards before the inferior part of the sacro-spinalis muscle, passes through it, furnishing it with a great number of filaments, and loses itself in the glutæus maximus and skin.

1750. *Anterior Branch.* It is about the same size as that of the fifth lumbar nerve. On issuing from the first anterior sacral hole, it communicates, by two filaments, with the sacral ganglia, then descends outwards along the upper edge of the pyramidalis muscle, and joins above the sacro-lumbar nerve (1744), and below the second sacral nerve, thus contributing to the formation of the sciatic plexus.

OF THE SECOND SACRAL NERVE.

1751. *Posterior Branch.* Thicker than that of the preceding nerve, it communicates with it and the third, descends obliquely outwards, perforates the sacro-spinalis and glutæus maximus muscles, to which it gives filaments, and expands upon the posterior surface of the latter, and in the integuments of the hip and margin of the anus.

1752. *Anterior Branch.* It issues by the second anterior sacral hole, between the two upper slips of the pyramidal muscles, communicates with the sacral ganglia, descends outwards, and throws itself into the sciatic plexus, uniting with the anterior branches of the preceding and following nerves.

OF THE THIRD SACRAL NERVE.

1753. *Posterior Branch.* It communicates, at its leaving the third posterior sacral hole, with the corresponding branches of the second and fourth sacral nerves, descends outwards under the origins of the glutæus maximus, passes through that muscle giving off some filaments to it, becomes subcutaneous, expands and sends its filaments into the integuments of the lower and inner part of the hip and margin of the anus.

1754. *Anterior Branch.* Smaller than that of the first two pairs, it communicates with the sacral ganglia, throws filaments into the hypogastric plexus, descends outwards, and, uniting with the two neighbouring nerves, enters into the sciatic plexus.

OF THE FOURTH SACRAL NERVE.

1755. The two branches of this nerve are precisely similar to those of the preceding nerves, and do not require to be particularly described. The anterior enters into the formation of the sciatic plexus.

OF THE FIFTH AND SIXTH SACRAL NERVES.

1756. *Posterior Branches.* They are considerably smaller than those of the preceding nerves. They communicate with each other, and the fifth moreover receives a filament from the fourth. They then lose themselves around the anus.

1757. *Anterior Branches.* That of the fifth passes between the sacrum and coccyx, and that of the sixth escapes through the lateral and superior notch of the latter bone. They communicate with each other and with the fourth, but contribute very little to the sciatic plexus. They are distributed to the ischio-coccygeus, levator ani and sphincter ani muscles.

OF THE SCIATIC OR SACRAL PLEXUS.

1758. It is particularly formed, as we have already said, by the anterior branch of the fifth lumbar nerve, and by that of the first four sacral nerves. It occupies the lateral and posterior part of the excavation of the pelvis, and lies upon the pyramidalis muscle, behind the hypogastric vessels, the rectum and bladder, the uterus and a great quantity of adipose tissue. Its breadth is much greater internally, where it is limited by the anterior sacral holes, than externally, where it is continuous with the sciatic nerve; and its structure is different from that of the other plexus which we have hitherto had occasion to examine. In place of forming a kind of net-work, by sending twigs to each other, the branches of which it is formed, join immediately so as to give rise to a kind of thick nerve flattened from before backwards.

1759. The branches and twigs which it furnishes may be distinguished into anterior and posterior. The former, which arise especially from the third and fourth sacral nerves, and whose number is very variable, are the hemorrhoidal, vesical, vaginal and uterine nerves. The others are the inferior glutæal and pudic nerves.

OF THE ANTERIOR BRANCHES AND TWIGS OF THE SCIATIC PLEXUS.

1760. *Hæmorrhoidal Nerves.* They direct themselves towards the lower part of the rectum, penetrate its posterior wall, and separate into *ascending filaments*, which proceed upwards toward the sigmoid flexure of the colon and *descending filaments*, which extend to the sphincter ani. Their ramifications stop in part in the muscular coat of the intestine, and are in part expanded in its mucous membrane.

1761. *Vesical Nerves* or *Nerves of the Bladder.* These nerves vary in number, and are irregularly interlaced, like the preceding, from which they often arise in part. They pass over the sides of the rectum, and gain the lateral parts and fundus of the bladder, to the muscular fibres and mucous membrane of which they are distributed. Some of their filaments are expanded, in the male, in the prostate gland and vesiculæ seminales, and, in the female, in the walls of the urethra.

1762. *Uterine* and *Vaginal Nerves.* These nerves exist only in the female. They arise in part separately, in part confounded with the preceding, pass over the sides of the rectum, and penetrate, separating from each other, into the whole extent of the lateral parts of the vagina, to the mucous membrane of which they are distributed. Those which are highest gain the sides of the neck and body of the uterus, where they expand. They are less numerous than those of the vagina.

1763. All these nerves are so intermingled with each other, that it becomes very difficult to trace them individually. They are besides interlaced in a more or less intimate manner with the filaments of the lumbar and sacral ganglia which form the hypogastric plexus, so that they really contribute to the formation of that plexus.

OF THE POSTERIOR BRANCHES OF THE SCIATIC PLEXUS.

1764. *Inferior Glutæal* or *Small Sciatic Nerve.* It is furnished, at the posterior and inferior part of the plexus, by the second and third sacral nerves. It also receives some more or less slender roots from the fourth sacral nerve and pudic nerve. Leaving the plexus at the same time with the sciatic nerve, it issues from the pelvis along with it by the sciatic notch, and beneath the pyramidalis muscle. It then almost immediately divides into a great number of twigs which are distinguished as follows :

1*st*, *Glutæal Twigs properly so called.* (*Nervi glutæi medius et inferior*, Soemm.) Existing in small number, slender and rather short, they generally separate from the nerve by a common trunk, of which the *ascending twigs*, winding over the inferior edge of the pyramidalis muscle, lose themselves by numerous filaments at the upper part of the anterior surface of the glutæus maximus, while the *descending twigs*, which are less numerous, are all at once distributed into its substance. One of the ascending twigs, which is larger than the rest, directs itself from within outwards, proceeding as far as the outer edge of that muscle.

2. *Sciatic Twig.* (*N. pudendalis longus inferior*, Soemm.) It curves inwards and upwards, forming a kind of reversed arch under the tuber ischii. At the end of a short course, it expands into a great number of filaments, some of which penetrate into the inner and lower part of the glutæus maximus, while the others are distributed to the integuments of the inner and upper part of the thigh, the perineum and penis, to the middle region of which they extend.

3. *Crural Twig.* It is larger than the others, and is placed at their outer part. It passes before the glutæus maximus, over the lower edge of which some filaments curve upwards to be expanded upon its posterior surface. It then becomes subcutaneous, continues to descend at the back part of the thigh beneath the crural aponeurosis, through which it successively sends to the integuments a great number of filaments which run a longer or shorter course. When it has arrived at the ham, it divides into two or three filaments which descend behind the leg superficially, and lose themselves in its integuments by a great number of subdivisions. They sometimes extend as far as the heel.

1765. *Pudic Nerve.* (*Nervus pudendalis superior*, Soemm.) Arising principally from the third and fourth sacral nerves, and sometimes from the fifth, it sends a commencing twig to the preceding (1764), issues from the pelvis along with it under the pyramidalis muscle, enters between the two sacro-sciatic ligaments along with the internal pudic artery, and separates into two twigs, a superior and an inferior.

1766. *Inferior Twig in the Male.* At first parallel to the superior for some time, and ascending along the inner part of the sciatic tuberosity, it sends some filaments to the levator and sphincter ani muscles, and to the neighbouring adipose tissue and integuments. It then proceeds from behind forwards and from below upwards, along the perineum, between the bulbo-cavernosus and ischio-cavernosus muscles, and gains the scrotum, where it loses itself chiefly in the dartos by a great number of filaments. But previously, it gives off filaments to the transversus perinæi, bulbo-cavernosus and ischio-cavernosus muscles, as well as to the integuments. Some of these filaments, traversing the walls of the urethra, expand upon the inner surface of that canal.

1767. *Superior Twig in the Male.*—It ascends along the ramus of the ischium and that of the pubes, and gains the symphysis pubis. It then glides between it and the corresponding root of the corpus cavernosum, arrives at the upper surface of the penis, runs along it as far as the corona glandis, and terminates in that part as well as in the prepuce by a great number of ramifications. But in this course, it furnishes filaments to the obturator internus and bulbo-cavernosus muscles, the mucous membrane of the urethra, the skin of the back of the penis, and the cellular tissue of the groove of the corpus cavernosum.

1768. *Of the Pudic Nerve in the Female.*—The *inferior twig*, which is proportionally much larger than in the male, gives off several divisions along the perineum, penetrates into the labium externum of its side, distributes some filaments to it as well as to the constrictor vaginæ and ischio-cavernosus muscles, and, directing itself over the sides of the clitoris, arrives at the mons veneris, where it is lost. The *upper twig*, which is very slender, ascends along the ramus of the pubes, before the obturator internus muscle, gives off filaments to the latter, and gains the back and summit of the clitoris, where it ramifies.

OF THE SCIATIC NERVE.

1769. The *Sciatic Nerve (Nervus ischiadicus*, Soemm.) is the thickest and longest of all the nerves of the body, and terminates the plexus of the same name, all the roots of which contribute to form it. It descends at first before the pyramidalis muscle, gives it some filaments, issues from the pelvis between it and the gemellus superior by the sciatic notch, and enters between the great trochanter and the tuber ischii. It then descends a little obliquely outwards, along the posterior part of the thigh as far as the ham, where it divides into two principal trunks, of which one is the external, the other the internal popliteal nerve, and which are sometimes distinct from the upper part of the limb.

1770. By its anterior side, the sciatic nerve is successively applied, from above downwards, upon the two gemelli muscles, the tendon of the obturator internus, and the quadratus femoris and adductor magnus. Its *posterior side* is covered above by the glutæus maximus, inferiorly by the long portion of the biceps flexor, and a little by the semi-tendinosus. Lastly, altogether inferiorly, it is placed in the ham in the midst of fat, under the crural aponeurosis and skin, and between the biceps and semi-membranosus (1298.)

1771. On emerging from the pelvis, the sciatic nerve gives off some twigs to the gemelli, obturator internus and quadratus muscles. The glutæus maximus also generally receives several, unless when the twigs of the inferior glutæal nerve (1764) are very large, in which case, the sciatic nerve sends none to it. Two or three twigs go to the long portion of the biceps muscle. One of them accompanies it as far as the knee, and sometimes becomes cutaneous. Another is destined for the short portion of the same muscle. The last twigs are expanded in the semi-tendinosus, semi-membranosus, and adductor magnus muscles. Among these twigs, there are many which extend as far as the skin, in which they terminate, whether on the thigh or on the leg.

1. OF THE EXTERNAL POPLITEAL NERVE.

1772. The external popliteal, *Fibular* or *Peroneal Nerve*, which is smaller than the internal, descends obliquely outwards along the inferior extremity of the biceps muscle, behind the outer condyle of the femur and the tendon of the corresponding head of the gastrocnemius; then, bending a little forwards and inwards, passes between the upper part of the fibula and the peroneus longus muscle, and there divides into two branches, the musculo-cutaneous, and the anterior tibial.

1773. At its origin, and sometimes even a little before, this nerve gives off a long and slender filament, which glides between the femur and the inferior extremity of the biceps, gives some ramifications to the latter muscle, and then expands upon the fore and outer part of the knee joint, and upper articulation of the tibia and fibula. Before arriving at the condyles of the femur, it gives off another twig of remarkable size (the *peroneo-cutaneous* twig of Chaussier,) which sends a great number of filaments to the outer head of the gastrocnemius, over which it descends, keeps along the outer and back part of the leg, beneath the aponeurosis, and separates into many other filaments which lose themselves in the integuments. One of them, however, which is larger than the other, and frequently arises separately, unites at the outer edge of the tendo Achillis with a twig of the internal popliteal nerve, to form the external saphenus nerve..

1774. *Musculo-cutaneous Branch* or *External Fibular Nerve*. It descends at first a little obliquely inwards and forwards between the peroneus longus and extensor communis digitorum pedis, then between the latter and the peroneus brevis, to all which it sends filaments, as well as to the peroneus tertius. Towards the middle of the leg, this nerve becomes more superficial, and is situated under the aponeurosis, behind which it creeps for some time. It perforates it about two thirds down, sends outwards some filaments into the integuments which cover the lower extremity of the fibula, and divides into two twigs which direct themselves superficially over the back of the foot, diverging from each other, the one internal and larger, the other external and smaller.

1775. *Internal and Superficial Twig of the Back of the Foot*. It directs itself inwards, and gives at first several filaments to the integuments, which communicate with those of the internal saphenus nerve (1742.) When it has arrived at the foot, it bifurcates and produces two divergent secondary twigs. The *inner* follows the corresponding edge of the foot, furnishes several filaments to the cellular tissue, the integuments, and the muscles of the great toe, and runs along the first metatarsal bone and great toe, reaching almost to its extremity. The *outer* runs between the first two metatarsal bones, and sends its ramifications over the upper and outer part of the second.

1776. *External and Superficial Twig of the Back of the Foot.* It runs along the middle part of the upper surface of the foot, between the tendons of the extensor muscles of the toes and the integuments, after sending some filaments over the outer malleolus. Towards the posterior extremity of the metatarsus, it separates into three secondary twigs. The *inner* is prolonged between the second and third metatarsal bones, and spreads its divisions over the outer side of the second toe and the inner side of the third. The *middle twig*, passing between the third and fourth metatarsal bones, is distributed in the same manner to the third and fourth toes. Lastly, the *outer* runs in the interval between the fourth and fifth metatarsal bones, and loses itself on the corresponding toes. Frequently this twig is replaced by one of the twigs of the outer saphenus nerve, but it always at least communicates with it.

1777. *Anterior Tibial Branch.* It traverses the upper extremity of the peroneus longus and extensor digitorum communis, descends at first obliquely inwards between the fibula and these two muscles, gives them several filaments, then directs itself between the fibula and the extensor proprius pollicis and tibialis anticus, before the interosseous ligament and along the anterior tibial artery, which is placed internally of it above, and externally below. After passing under the annular ligament of the tarsus along with the tendon of the extensor pollicis muscle, this nerve separates on the back of the foot into two twigs, an inner and an outer, both deeply seated.

1778. The largest of the twigs of this nerve, before its division, arises near its origin. It traverses horizontally the upper extremity of the extensor communis digitorum, and divides into several filaments, of which the inferior are distributed to that muscle and the tibialis anticus, while the upper ascend under the origin of the latter, and lose themselves around the knee joint. It also sends lower down a considerable twig to the extensor digitorum communis, and two or three others to the extensor proprius pollicis and tibialis anticus.

1779. *Internal and Deep Twig of the back of the Foot.* It runs along the inner edge of the extensor brevis digitorum pedis, to which it gives some filaments, passes under the portion of it destined for the great toe, places itself between the first two metatarsal bones, sends ramifications to the first dorsal interosseous muscle, and to the integuments, and at length divides into two filaments, which spread out, the one on the outer side of the first toe, the other on the inner side of the second, communicating with the superficial filaments already indicated (1775).

1780. *External and Deep Twig of the back of the Foot.* It passes outwards and forwards under the posterior part of the extensor brevis digitorum, and then divides into a great number of filaments, which are distributed to that muscle and the interossei.

2. OF THE INTERNAL POPLITEAL OR TIBIAL NERVE.

1781. The Internal Popliteal Nerve is larger than the preceding, and seems to be the true continuation of the sciatic nerve. It descends at first nearly vertically into the ham, along the outer edge of the semimembranosus muscle, between the crural aponeurosis and the popliteal vessels, from which it is commonly separated by much adipose tissue. Then entering between the two heads of the gastrocnemius, it passes behind the knee joint and the poplitæus muscle, then between the latter and the upper extremity of the soleus. There it passes through the arched aperture which that muscle presents (1337), and takes the name of *Tibial Nerve.* It then descends along the leg, between the soleus muscle, which is behind it, and the tibialis posticus and flexor longus digitorum, which are before, and externally of the posterior tibial artery, with which it is closely connected. Towards the lower part of the leg, it becomes superficial, places itself on the inner side of the tendo Achillis, dives under the arch of the calcaneum, above the origin of the abductor pollicis, and divides into two branches, one of which is the internal, the other the external plantar nerve.

1782. *External Saphenal Twig.* It arises from the internal popliteal nerve, at about an inch above the corresponding condyle of the femur, descends with the external vena saphena along the back part of the leg, in the interval which separates the two heads of the gastrocnemius muscle above. It then places itself behind their union, gains the outer side of the tendo Achillis, sends several filaments to the integuments, and joins a twig of the external popliteal nerve (1773). There results a pretty large trunk, which is named the *External Saphenus Nerve*, and which continues to descend on the outer side of the leg, behind the peroneus longus and under the aponeurosis. There then proceed from it a great number of filaments which almost all enter beneath the tendo Achillis, and are spread out to a distance upon the sheath which is anterior to it. It then winds behind the outer ankle, gains the outer and upper extremity of the foot, reaches the posterior extremity of the fifth metatarsal bone, and there divides into two secondary twigs, after sending several filaments to the abductor minimi digiti, and surrounding cellular tissue. Of these two twigs, the *inner*, which is placed above the extensor brevis digitorum, follows the fourth metatarsal bone and loses itself on the corresponding sides of the last two toes; while the *outer* runs along the outer edge of the foot and little toe, and distributes there a certain number of filaments.

1783. In the hollow of the ham itself, the internal popliteal nerve sends one or two very distinct twigs to the upper part of each head of the gastrocnemius muscle. It gives off another, which divides in the soleus muscle after a considerable course. It also furnishes some to the popliteus and plantaris muscles, and to the knee joint; while a last twig winds under the lower edge of the popliteus muscle, sends off a long filament which follows the course of the posterior tibial artery, gives some others to the tibialis posticus muscle, passes through the superior aperture of the interosseous ligament, and is expanded in the upper part of the anterior muscles of the leg, anastomosing with the filaments of the anterior tibial nerve.

1784. After passing through the arch of the soleus muscle, the internal popliteal nerve furnishes several long and slender filaments which descend surrounding the posterior tibial artery, and anastomose frequently with each other. They then lose themselves in the lower part of the soleus and of the muscles which occupy the posterior and deep region of the leg. Farther down, there are detached some other filaments which go to the integuments. But towards the inner ankle, there arises another, which, uniting with one of the preceding, goes to the integuments of the sole of the foot.

1785. *Of the Internal Plantar Nerve.* Thicker than the outer, which forms an acute angle with it at its separation, it proceeds directly and horizontally forwards above the abductor pollicis, beside the tendon of the flexor longus pollicis, to the posterior extremity of the first metatarsal bone, and in its passage gives ramifications to the abductor pollicis, flexor brevis digitorum, and accessorius muscles. But there, it separates in a variable manner into four twigs, which may be designated by their numerical names, counting from within outwards. The *first*, which is smaller than the others, follows the inferior surface of the flexor brevis pollicis, which receives some filaments from it, proceeds along the lower and inner part of the great toe, and loses itself upon it, sending at the same time some filaments upwards. The *second*, which is directed horizontally forwards, between the first two metatarsal bones, at first above, then below the flexor brevis digitorum, which receives several filaments from it, as does also the first lumbricalis muscle, separates opposite the first metatarso-phalangeal articulation, into two secondary twigs, one of which is distributed on the outer side of the first toe, while the other is spread out upon the inner side of the second, sending upwards some filaments which anastomose with those of the internal and deep nerve of the back of the foot (1779), and which themselves anastomose by arches in the pulp of the toes. The *third*, which is placed between the second and third metatarsal bones, gives filaments to the second lumbricalis muscle, and is distributed upon the second and third toes precisely in the same manner as the preceding twig. Lastly, the *fourth*, advances between the third and fourth metatarsal bones, and is distributed to the corresponding toes.

1786. *Of the External Plantar Nerve.* This proceeds obliquely forwards and outwards, between the flexor brevis digitorum and accessorius muscles, to which it gives filaments, and in the kind of groove situated near the large tuberosity of the calcaneum. Arrived at the posterior extremity of the fifth metatarsal bone, it divides into two branches, the one superficial, the other deep.—But before this, it generally sends a pretty large twig to the abductor minimi digiti.

1787. *Superficial Branch.* It advances under the outer edge of the foot, and soon divides into two twigs; an *outer*, which gives a filament to the flexor minimi digiti, and loses itself on the corresponding edge of the little toe; and an *inner*, which directs itself between the last two metatarsal bones, gives a filament to the fourth lumbricalis, communicates with the preceding twig, and subdivides on the contiguous sides of the fourth and fifth toes.

1788. *Deep Branch.* At its commencement it furnishes a filament to the flexor brevis minimi digiti, and dives, ascending inwards and forwards between the interossei muscles and abductor pollicis pedis, forming a kind of arch of which the posterior side, does not give off filaments, while the anterior sends some to the interossei and transversus pedis.

III. OF THE NERVOUS SYSTEM OF GANGLIA, OR OF THE GREAT SYMPATHETIC AND INTERCOSTAL NERVES OF MANY AUTHORS.

GENERAL OBSERVATIONS.

1789. The *Ganglia* are small nervous centres, from the circumference of which proceed filaments which anastomose with the neighbouring nerves, or lose themselves in the tissue of the organs. They are only met with in the trunk, the limbs being entirely destitute of them. They all communicate with each other, and are possessed of a peculiar stricture. They invariably present themselves under the appearance of small reddish or grayish bodies, always deeply situated in the midst of cellular tissue, destitute of any particular envelope, and varying considerably in form and magnitude. Their tissue, which is soft and spongy, is homogeneous, and presents no traces of fibres or filaments at first sight. From careful dissection, however, it is thought to be composed of a multitude of nervous filaments. This is at least Scarpa's opinion, and as such deserves attention. It hardens by boiling, at least when not long continued. When this is the case, it, on the contrary, gradually softens and becomes pulpy. It is partly dissolved by alkalies, and long resists putrefaction.

The ganglia contain very little cellular tissue in their interior.

They receive a great quantity of blood-vessels which penetrate them on all sides, ramifying and anastomosing frequently in their interior.

1790. The nervous filaments which emanate from the ganglia adhere to them in an intimate manner, without appearing to be a continuation of their substance, and are surrounded by the same cellular substance as they. They communicate with the encephalic nerves a great many times, connect the ganglia themselves with each other, seldom penetrate the muscles, form very numerous plexus with each other, principally around the arteries, and even seem especially destined to follow the arterial system in all its ramifications, being but very seldom observed around the veins.

Some of these nervous filaments are white, composed of fibrils like the encephalic nerves, and like them also surrounded with a neurilemma. Others are reddish or gray, not fibrous, and destitute of neurilemma, at least in so far as would appear.

OF THE GANGLIA IN PARTICULAR, AND OF EACH OF THE NERVES WHICH ARISE FROM THEM.

I. GANGLIA OF THE HEAD.

OF THE OPHTHALMIC OR LENTICULAR GANGLION.

1791. This is one of the smallest ganglia of the body. It is placed against the outer side of the optic nerve, not far from its entrance into the orbit, and is always met with. Its form, although subject to vary, is yet frequently that of a square, elongated from behind downwards. Its *outer surface*, which is convex, corresponds to the abductor oculi muscle. The *inner* is concave and applied upon the optic nerve. Its colour is reddish, sometimes white. Its volume differs much according to the individual. Lastly, it is immersed in a mass of soft, and as it were half-fluid fat. Its *posterior and superior angle* communicates with the nasal nerve of the ophthalmic (1582); the *posterior* and *inferior* with a filament of the inferior branch of the common motor nerve of the eye, (1567.) Its two *anterior angles* also furnish each a bundle of small nerves, the one superior the other inferior. These are the

1792. *Ciliary Nerves.* They are very slender, soft, flexuous, reddish, and constantly accompanied by one, two, or three filaments coming immediately from the nasal nerve, (1582,) and which have exactly the same distribution.

The *upper bundle*, which is smaller, is at first divided into three nerves, which bifurcate as they advance, so as to produce six, which proceed parallel to each other immediately above the optic nerve, which they accompany as far as the ball of the eye.

The *lower bundle*, which is situated without and beneath the optic nerve, and at a little distance from it, contains six, eight or ten nerves, or even a greater number, which are united into six small branches at their origin. They wind round the optic nerve. Some of them even pass beneath it to gain its inner side. Another separates from the bundle, proceeds outwards, frequently anastomoses with one of the filaments of the nasal nerve, and gains the sclerotic membrane by itself under the rectus externus oculi muscle.

1793. These nerves, which are in all from twelve to sixteen on arriving at the posterior part of the ball of the eye, pass separately and obliquely through the sclerotic membrane, at a greater or less distance from the optic nerve. They are previously interlaced with the ciliary arteries, but do not anastomose with each other or form a plexus. On entering the eye, they become a little flattened, and are converted into a kind of small bands, which advance forwards between the sclerotic and choroid membranes, but without giving off filaments to either, and are lodged in narrow grooves formed upon the inner surface of the sclerotica. They are then parallel to each other, and frequently send off communicating filaments.

1794. They thus arrive at the ciliary circle, subdivide each into two, sometimes into three filaments, which enter into that circle, and seem to lose themselves there. Some of these filaments, arriving at the fore part of the eye, perforate the choroid membrane, penetrate into the ciliary processes, all bend backwards, and lose themselves in the place where the retina joins the ciliary circle. On the other hand, the ciliary circle sends to the iris a multitude of other filaments which do not appear to be continuations of the first, an arrangement which has induced several anatomists to consider the ciliary circle as a true ganglion; and it cannot be denied that its colour and texture give additional weight to this opinion. The ciliary filaments which are expanded upon the iris form white lines which gain its small circumference.

1795. If the ciliary circle be considered as a ganglion, the communication of the ophthalmic ganglion with it is evident. The latter has also connections with the superior cervical ganglion or with the cavernous ganglion, by a filament which they send to the nasal nerve (1582), and which appears to adhere to it, and to form especially that which goes to the superior and posterior angle of the ganglion.

OF THE SPHENO-PALATINE GANGLION, OR GANGLION OF MECKEL.

1796. This is a small reddish body, somewhat hard, triangular r cordiform, of variable, but always inconsiderable size, convex n its outer surface, flattened on the inner side, and placed externally of the spheno-palatine foramen. Immersed in the adipose cellular tissue of the pterygo-maxillary fissure, it is deeply concealed between the bones, and difficult to be discovered. It furnishes a great number of twigs from the different points of its circumference. The *inner* are the spheno-palatine nerves; the *inferior*, the palatine. The *superior* form communications with the superior maxillary nerve, as we have already shown (1587). Lastly, the *posterior* is the vidian or pterygoid nerve.

1797. *Of the Spheno-palatine Nerves.* Their number varies from three to five at the moment of their origin. They introduce themselves immediately into the nasal fossæ, through the spheno-palatine hole, near the posterior extremity of the middle turbinated bone. They are always very soft. They spread out upon the septum or outer wall of these cavities in the following manner. 1st, Two or three filaments proceed at first between the periosteum and the mucous lamina of the pituitary membrane, to the concave surface of the upper turbinated bone. They lose themselves in the corresponding meatus, near the aperture of the posterior ethmoid cells (357,) without its being yet ascertained whether they send ramifications into these cellules. 2dly, Other very short twigs go to the middle turbinated bone. The highest of them, after running for some time upon its convex surface, passes through it by a small hole, and loses itself upon its concave surface in the membrane. The others terminate upon its posterior extremity. 3dly, Some extremely slender twigs unite into one, and wind before the sphenoidal sinus, to gain the posterior part of the septum. 4thly, Larger than the preceding, a twig, named the *Naso-palatine*, winds at first before the sphenoidal sinus, traverses the arch of the nasal fossæ, and passes to the septum between the two laminæ of the pituitary membrane. It descends very obliquely forwards along the septum, and thus arrives, without ramifying, at the superior aperture of the anterior palatine canal (354.) There, it introduces itself into a canal of its own, and of which we have already spoken. The twig of the right side is prolonged a little more forwards than the left, to meet the orifice destined for its reception. But both, on arriving at the middle of the anterior palatine canal, issue from their particular canals, and terminate at the upper angles of the naso-palatine ganglion, without reaching so far as the mouth. The naso-palatine nerve distinctly anastomoses with a filament coming from the superior and anterior dentar nerve, which extends along the wall of the maxillary sinus to penetrate into the nasal fossæ.

1798. *Of the Palatine Nerves.* They are three in number, one large and two small.

1799. The *Great* or *Inferior Palatine Nerve*, placed before the other two, enters immediately into the posterior palatine canal (366,) after always giving off a *nasal* filament which introduces itself into the fossæ of that name, between the middle and inferior turbinated bones, opposite the sphenoidal process of the palatine bone, and which is distributed to the free edge of the middle turbinated bone, to its concave surface, and to the convex surface of the inferior turbinated bone, extending to near its anterior extremity.

The great palatine nerve then runs through its canal, where its filaments are frequently spread out, and only connected by a loose cellular tissue. A little before issuing from it, it sends a second ramification into the nasal fossæ. This latter passes through a small aperture of the vertical portion of the palate bone, proceeds horizontally along the edge of the inferior turbinated bone, and loses itself on the ascending process of the superior maxillary bone. It is often contained in a small bony canal.

At the same place the palatine nerve transmits, by one of the accessory canals, a filament which goes to the velum palati to be distributed there. The nerve itself then immediately issues from its canal, directs itself forwards under the arch of the palate, and separates into several twigs. The *outer*, which are larger and more numerous, follow the inner edge of the superior alveolar arch, and lose themselves in the gums. The *inner* subdivide on the middle of the vault of the palate, and especially furnish filaments to the mucous follicles of that region. Some of them anastomose with the inferior filaments of the naso-palatine ganglion.

1800. *Middle Naso-palatine* or *Guttural Nerve.* Arising behind the preceding nerve, it descends along the posterior part of the pterygo-maxillary fissure, enters a canal of its own, and emerges behind the hook of the pterygoid process, dividing into two filaments, one of which goes to the corresponding tonsil and terminates by four or five ramifications in the velum palati, while the other, which separates into two or three filaments, is entirely destined for the latter organ.

1801. *Small Palatine Nerve.* Situated still farther back than the preceding, it descends between the pterygoideus externus muscle and the superior maxillary bone, then between the latter and the palatal bone, in a groove of its own, and divides into two filaments, one for the uvula, the other for the tonsil and the follicles of the membrane of the palate.

1802. *Of the Vidian or Pterygoid Nerve.* On leaving the spheno-palatine ganglion, it proceeds horizontally backwards, sends two very slender filaments to the membrane of the sphenoidal sinus, enters the pterygoid canal (114), and passes through it, giving off, through its walls, ramifications to the upper and back part of the septum of the nasal fossæ, the membrane of the pharynx near the orifice of the Eustachian tube, and that orifice itself. On issuing from its canal, the vidian nerve traverses the fibro-cartilaginous plate which closes the foramen lacerum anterius (218), and divides into two twigs, a superior and an inferior.

The *inferior* or *carotid twig* serves as a medium of communication between the spheno-palatine ganglion and the cavernous and superior cervical ganglia. It passes into the carotid canal applying itself against the walls of the artery, and anastomoses with the filaments which the superior cervical ganglion sends to the external motor nerve of the eye (1602) and cavernous ganglion.

The *Superior* or *Cranial Twig*, by a rather complex course, forms a communication between the spheno-palatine and sub-maxillary ganglia. On leaving the vidian nerve, it enters into the skull between the petrous process and the sphenoid bone, and proceeds backwards and outwards over the upper surface of the former, where it is lodged in a small groove, and covered by the inferior maxillary nerve and the dura mater, to the last of which it firmly adheres. There it sends into the cavity of the tympanum, by two canals whose very minute orifices are seen in the groove one above the other, two excessively delicate filaments, which anastomose with each other upon the promontory, and communicate with another filament of the superior cervical ganglion and with the glosso-pharyngeal nerve. It then glides along with a small artery into the hiatus of Fallopius, and arrives in the aqueduct of the same name, where it is applied against the trunk of the facial nerve, without anastomosing with it, (1608). It accompanies it until opposite the base of the pyramid of the tympanum, beneath which it penetrates into that cavity by an aperture of its own, winding upwards and outwards. After sending a filament to anastomose upon the promontory with a filament of the internal carotid plexus, (1605), it traverses the tympanum from behind forwards, placed at first under the incus, then between its long branch and the upper part of the handle of the malleus, against which it is directly applied. Above the internal muscle of the malleus, it increases a little in size and consistence, and its direction becomes horizontal, but presently after it descends forwards and issues by the glenoid fissure, beside the tendon of the anterior muscle of the malleus. It then directs itself downwards, inwards, and forwards, and becomes attached to the lingual nerve of the inferior maxillary, (1598). From its entrance into the tympanum to this union, the filament of which we speak commonly bears the name of *Corda Tympani*. It remains united to the lingual nerve until opposite the sub-maxillary gland, where it leaves it to go to the ganglion of the same name.

OF THE NERVOUS GANGLIA OF THE HEAD.

1803. Besides those described above, the following ganglia are met with in the head.

1. The *Cavernous Ganglion*. Situated in the cavernous sinus of the dura mater, this ganglion does not always exist, and is frequently substituted by a small plexus which the ascending filaments of the superior cervical ganglion form around the internal carotid artery. Its colour is of a pretty deep reddish gray, its volume generally small, and its form variable. It is placed at the outer side of the internal carotid artery, towards the middle of the cavernous

sinus, and sends off very slender filaments which proceed towards the external motor and ophthalmic nerves. It frequently sends one to the nasal nerve, to communicate with the ophthalmic ganglion. I have also seen it furnish a filament to the pituitary shaft. By its lower part, it communicates with the ascending filaments of the superior cervical ganglion.

2. The *Naso-palatine Ganglion.* I discovered this in the anterior palatine foramen,* at the point of union of the two branches of which, it is situated. It is a small reddish spongy mass, somewhat hard and as if fibro-cartilaginous, and immersed in an adipose cellular tissue. Its more ordinary form is that of an ovoid, of which the large extremity, directed upwards, receives the two naso-palatine twigs, (1797), while the small extremity sends off inferiorly one or two filaments which enter into small bony canals of their own, and arrive at the palatal arch, where they ramify in the membrane of the palate, anastomosing with filaments of the great palatine nerve, (1799).

3. The *Sub-Maxillary Ganglion.* It occurs at the level of the submaxillary gland, and seems formed by the upper twig of the vidian nerve. It has also some filaments of communication with the lingual nerve of the inferior maxillary (1597); but the greater number of its filaments form a small plexus the twigs of which penetrate the gland.

4. Another ganglion is mentioned as occurring in the head, along the course of the superficial temporal nerve; but it is merely an enlargement of that nerve at the moment when it it is covered by the parotid gland (1600).†

2. OF THE GANGLIA OF THE NECK, OR CERVICAL GANGLIA.

OF THE SUPERIOR CERVICAL GANGLION.

1804. This ganglion, which is remarkable for its size and the regularity of its occurrence, is situated under the base of the skull, deeply concealed in a depression which is observed above the angle of the lower jaw and behind it. It commonly corresponds in extent to the transverse processes of the first three vertebræ; but it is frequently prolonged to the fourth, and even much lower. It is of an olive tint, ovoidal or fusiform, broader at the middle than at the extremities. Its thickness is always in the inverse ratio of its length, so that its volume is very subject to variation. It pretty frequently experiences a contraction in its middle part, so as to appear double. Sometimes it is cylindrical. Its colour is of a grayish red, its consistence soft. Its *posterior side* lies upon the rectus capitis anticus major. The *anterior* is covered by the internal carotid artery. The internal is intimately united to the pneumo-gastric and hypoglossal nerves. It receives a pretty considerable number of small blood vessels, and sends from its periphery a great quantity of filaments, which are distinguished into superior, inferior, external, and anterior.

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* See my *Dissertation sur les Odeurs, sur le sens et les organes de l'olfaction*, &c. Paris, 1815, 4to.

† There is commonly designated by the name of *Great Sympathetic Nerve*, the aggregate of all the ganglia that are met with from the upper part of the neck to the lower part of the sacrum, together with the filaments which issue from them. But according to the idea which ought to be formed of the system of ganglia, it is impossible to see here only a single nerve.

1. OF THE SUPERIOR OR ASCENDING FILAMENTS.

1805. They are commonly two in number. Their great size, softness and reddish colour, make them look precisely like true prolongations of the ganglion. They embrace the internal carotid artery, and enter along with it into the carotid canal, where they separate from each other, dividing into many small twigs, come together, unite a great many times, and in a word form a true plexus around the walls of the vessel. From this plexus there issue several secondary filaments.

One of these, the *Pterygoid Filament* of Chaussier, glides under the artery, anastomoses with the inferior filament of the Vidian nerve (1802), and in uniting with it gives off two or three small twigs which are distributed to the upper part of the pharynx.

Two or three others, which are soft, transparent, of a gray colour, and pretty tough, ascend into the cavernous sinus, form a sort of isolated plexus by sending off some filaments, and unite with the external motor nerve of the eye (1600). When the cavernous ganglion exists, one or two of them unite with it, and the others go directly to the nerve (1803).

Occasionally some of these filaments come from the union of that of the superior cervical ganglion with the inferior twig of the Vidian nerve.

Several filaments, the *supra-sphenoidal* of Chaussier, go to the pituitary shaft (1435).

A very slender filament dives into a small aperture formed in the walls of the aqueduct of Fallopius (180), runs along a groove on a small canal formed on the promontory of the tympanum, and anastomoses there with a filament of the glosso-pharyngeal nerve which has entered towards the stylo-mastoid hole, and with another filament which separates in this place from the upper twig of the Vidian nerve (1802).

Another filament traverses the cavernous sinus and goes to join the ophthalmic nerve, or the nasal nerve. Sometimes it bifurcates and goes to both at once. It is by means of it that the superior cervical and ophthalmic ganglia communicate.

The other filaments of this plexus, which are very numerous, remain applied to the walls of the artery, to which they form a kind of nervous sheath. There is detached from them a pretty large bundle which accompanies the ophthalmic artery, and subdivides into as many small flexuous sheaths as that artery has branches. One of them follows the central artery of the optic nerve, and probably forms a communication between the retina and the superior cervical ganglion.* Other fasciculi accompany the other branches of the carotid artery which go to the pia mater, such as the anterior and middle cerebral arteries, &c. These latter are always pretty distinct.

2. OF THE INFERIOR FILAMENT.

1806. It comes from the inferior extremity of the ganglion, which seems to be prolonged downwards for the purpose of forming it, or which sometimes terminates in an abrupt manner and gives it off directly. It varies in size, is sometimes very slender and at other times double, but is never wanting. Its solidity gives it a resemblance to the encephalic nerves, from which it differs only in its gray colour. It descends vertically before the rectus capitis anticus major and longus colli muscles, covered by the carotid artery, the internal jugular vein, and the pneumo-gastric and hypoglossal nerves. It is connected with these parts by a rather loose filamentous cellular tissue. Opposite the fifth or sixth vertebra, it terminates in the middle cervical ganglion; but when this latter is wanting, it goes as far as the inferior, that is to say, to near the neck of the first rib.

1807. In its course, this nervous cord receives some long and slender filaments, which come from the third and fourth cervical pairs, increase its size a little, and join it at different angles, and pretty frequently forming small gangliform bulgings. Some other filaments, still more slender, appear to separate from it internally to go to the œsophagus and neighbouring cellular tissue. One of them anastomoses with the external laryngeal nerve of the pneumo-gastric, and seems to be especially distributed to the thyroid body (1636). Lastly, it sends into the thorax one, two or three twigs, which contribute to the formation of the cardiac plexus.

3. OF THE EXTERNAL FILAMENTS.

1808. They are pretty numerous, and very distinct, and lie across the rectus capitus anticus major, more or less separated from each other, and frequently anastomosing in their course. The *two upper*, which are at first very close to each other, presently bifurcate each on their own side, and thus anastamose by four points with the nervous arch, which the sub-occipital and first cervical nerves form around the transverse process of the atlas (1655). The third is the longest. It also bifurcates; but one of its filaments goes to the anterior branch of the first cervical nerve, and the other to that of the second. The *inferior filaments*, which arise from the preceding cord of communication, whose ganglion is very short, send filaments into the scaleni muscles. One of them also divides into two secondary filaments, of which the upper dives between the scalenus and rectus capitis anticus muscles, to anastomose with the third cervical pair, at the moment when it leaves the intervertebral hole, while the inferior, which is more superficial, goes to unite, at a greater distance, with the anterior branch of the same nerve.

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* Ribes, Mem. de la Société Medic. d' Emul. T. vii. p. 97.

Several other of these filaments anastomose, moreover, very frequently, and in an irregular manner, with the branches of the cervical plexus. It is impossible to describe them separately, their disposition being so much subject to vary.

4. OF THE INTERNAL FILAMENTS.

1809. All these filaments are soft, thin, and slender, and exposed to still greater variations than the preceding as to number, disposition, anastomoses, &c. It may be stated generally, however, that after distributing several ramifications to the rectus capitis anticus major and longus colli muscles, they terminate on the larynx and pharynx, whether separately, or united with nerves from the brain.

In some subjects, most of these are furnished by the connecting cord of the first two cervical ganglia, or by the superior cardiac nerve.

The upper have a direction obliquely downwards; the lower are nearly horizontal.

The former gain the upper part of the pharynx. There, they anastomose with twigs of the glosso-pharyngeal (1627), and pneumo-gastric nerves, to form the phanyngeal plexus (1634).

The latter wind over the sides of the larynx, and cover the thyroid body, and the muscles of the inferior hyoid region, with numerous and plexiform ramifications, some of which penetrate into the larynx through the thyro-hyoid (1406), and crico-thyroid (1407) membranes, and afterwards anastomose with the internal laryngeal (1635), and recurrent (1638) nerves. Some other anastomoses with the latter nerve also take place behind the thyroid gland by means of a filament which proceeds separately from the ganglion.

5. OF THE ANTERIOR FILAMENTS.

1810. These filaments, which are very numerous, and for the most part continually interlaced, are of three kinds.

1. Some of them, which are superior and very short, go to anastomose immediately with the facial, pneumo-gastric and hypoglossal nerves. The latter communication however but very rarely exists, perhaps even is never met with. One of these filaments, which is longer than the others and very slender, goes to unite with the stylo-hyoid twig of the facial nerve (1609), and sometimes sends a ramification into the stylo-mastoid hole, to form on the promontory of the tympanum the anastomosis of which we have already spoken (1725). This ramification then replaces one of those of the superior filaments, or it joins the trunk of the facial nerve itself.

2. Others, to the number of two or three only, of a reddish colour and soft consistence, leave the ganglion to proceed forwards, behind the point of division of the common carotid artery, where they form a plexus with numerous meshes, in conjunction with descending filaments of the glosso-pharyngeal nerve (1627). Of the filaments which issue from this plexus some run behind the common carotid artery, and accompany it as far as the arch of the aorta, or to the brachio-cephalic artery, crossing each other in a very intricate manner. They constitute the *Common Carotid Plexus.* The others turn over the external carotid artery, and envelope it with a plexus which divides into as many secondary plexus as the latter presents branches, and which are moreover joined by very slender filaments of the facial and pneumogastric nerves. Frequently at the origin of these *secondary lingual*, *facial*, *occipital*, *temporal*, *inferior pharyngeal*, and *internal maxillary plexus*, there are observed small white or gray ganglia which give out filaments to them like so many radii. The point at which these plexus terminate cannot be precisely determined; but it is more than probable, that they accompany the arteries to their last ramifications. They have been traced as far as the middle of the face, towards the division of the labial arteries.

The common carotid plexus sends some twigs to the pharnynx, the larynx and the trachea. That of the facial artery sends twigs to the submaxillary gland, and communicates with those of its ganglion (1803), and with those of the lingual nerve of the inferior maxillary, and of the hypoglossal nerve (1653). That of the internal maxillary artery arrives at the dura mater, by following the middle meningeal artery.

3. The last anterior filaments of the superior cervical ganglion unite after a short course, to form the *superior cardiac nerve*, of which we shall presently speak.

OF THE MIDDLE CERVICAL OR THYROID GANGLION.

1811. This ganglion, which is often entirely wanting, sometimes double, and which varies extremely as to size, is situated opposite to the fifth or sixth vertebra, near the curve of the inferior thyroid artery. Its colour is grayish. It is rounded or lenticular, but never fusiform, and differs much as to figure in different subjects. Its tissue is firmer than that of the preceding plexus.

The *outer side* corresponds to the carotid artery, internal jugular vein, and pneumo-gastric nerve. The posterior is applied upon the longus colli muscle.

Its filaments are distinguished into inferior, external, internal, and anterior.

1. OF THE INFERIOR FILAMENTS.

1812. Their number is irregular and indeterminate. Most commonly there are five or six. They are thin and slender. Some of them descend before the subclavian artery, others behind it, sending some ramifications into the plexus which cover it; and all, after approaching each other, terminate in the inferior cervical ganglion.

2. OF THE EXTERNAL FILAMENTS.

1813. Frequently there is only one, which perforates transversely the scalenus muscle, and goes to anastomose with the sixth cervical nerve. In other circumstances, the fifth and fourth also each receive one.

3. OF THE INTERNAL FILAMENTS.

1814. Some of them pass behind the carotid artery, and go to form a nervous plexus around the inferior thyroid artery and its divisions. Others cast themselves separately upon the thyroid body, œsophagus and trachea, where they anastomose with ramifications of the recurrent nerve; some of them even gain the trunk of the recurrent nerve, and increase its volume considerably; others unite with the common carotid plexus, and one of them joins the diaphragmatic nerve.

4. OF THE ANTERIOR FILAMENTS.

1815. They vary from one to three, and constitute the middle cardiac nerves, of which we shall afterwards speak.

OF THE INFERIOR CERVICAL GANGLION.

1816. It is sometimes double, and is pretty frequently continuous with the middle cervical ganglion or with the first thoracic ganglion. Its figure is extremely variable and irregular, although it is frequently semilunar or rounded. It is situated behind the vertebral artery, between the transverse process of the seventh cervical vertebra and the neck of the first rib. Sometimes it occurs between the concave edge of that rib and the body of the first dorsal vertebra; but it generally extends as far as the first intercostal space. Its filaments are superior, inferior, internal, external and anterior.

1. OF THE SUPERIOR FILAMENTS.

1817. Some of them communicate with the middle cervical ganglion. Of these we have already spoken (1812).

Another bundle of filaments throws itself outwards behind the vertebral artery, ascends in its canal forming around it a very distinct plexus, as far as the third or second vertebra. There, the filaments become less numerous and less apparent. One or two of them however are still seen to anastomose with a descending filament of the anterior branch of the sub-occipital nerve (1655). Some others enter into the skull and lose themselves on the basilar artery. In its course, this *Vertebral Plexus* sends a great number of small twigs to the inter-transversales muscles, near the body of the vertebræ, and anastomoses by a particular filament with each of the cervical nerves, at the moment when they leave the intervertebral holes.

Another ascending filament forms a kind of arch of which the convexity is below, and ascends outwards between the rectus capitis anticus major and longus colli muscles to which it gives ramifications.

2. OF THE INFERIOR FILAMENT.

1818. It communicates with the first thoracic ganglion, and is sometimes double. In the latter case, it commonly embraces the subclavian artery between its two branches.

3. OF THE INTERNAL FILAMENTS.

1819. Few in number, slender, and irregular in their disposition, these filaments take different directions. Some of them lose themselves in the longus colli muscle; the others go to the pulmonary plexus or to the arch of the aorta of the left side. There are some also which associate themselves with the recurrent and diaphragmatic nerves.

4. OF THE EXTERNAL FILAMENTS.

1820. They are numerous and very slender. Collected into fasciculi, they embrace the subclavian artery, around which they form a plexus which accompanies its branches, subdividing like them, and which may be traced with some care to the upper part of the arm. Those of the internal mammary artery in particular may be very distinctly seen. Some others lose themselves in the fibres of the scalenus anticus muscle, near its inferior attachment.

There are also external filaments which go to anastomose with the anterior branches of the cervical nerves, at the moment when they go to form the brachial plexus (1678), and with the first dorsal pair.

5. OF THE ANTERIOR FILAMENTS.

1821. They unite after a short course to form the inferior cardiac nerves.

OF THE CARDIAC NERVES.

1822. These nerves, which are particularly destined for the heart, and of which there are three on each side, do not present the same disposition to the right and left, and unite with the cardiac ganglion, from which the cardiac plexus are derived.

1. OF THE SUPERIOR CARDIAC NERVES.

1823. That of the right side is formed by five or six filaments which come from the anterior and inferior side of the first cervical ganglion. It is almost immediately strengthened by some small twigs, which detach themselves from the cord by which the ganglion communicates with the second (1806), and sends some filaments to the external carotid plexus. All these roots afterwards unite with a single very slender trunk, which descends vertically along the neck, by the side of the trachea and thyroid body, between the common carotid artery and the cord of communication of the cervical ganglia.

This nerve sends some filaments to the lower part of the pharyngeal plexus, and to the thyroid body. The latter anastomose with those of the recurrent nerve. It also communicates by one or two other filaments with the pneumo-gastric nerve. In general, all these ramifications have very little solidity, and some anatomists have given them the name of *Soft Nerves*. Opposite the middle cervical ganglion, it frequently presents a solution of continuity itself from the effect of a particular ganglion, which is by no means constant in its occurrence. There also, it furnishes internally a twig of remarkable size, which passes behind the carotid artery, and throws itself into the plexus of the inferior thyroid artery (1714), after anastomising upon the carotid with a filament of the pneumo-gastric nerve. There also comes off from it another filament at the same point, which communicates with the plexus of the cervical branch of the great hypoglossal nerve (1652). Some others are distributed to the muscles of the inferior hyoid region, the thyroid body, and the trachea.

The superior cardiac nerve then passes outwards, crosses posteriorly the direction of the middle cardiac nerve, penetrates into the thorax behind the subclavian vein, opposite the bifurcation of the brachio-cephalic artery, and presently divides into several twigs which associate themselves with filaments of the inferior cervical ganglion and corresponding recurrent nerve. Sometimes also, it unites in part with the middle cardiac nerve.

1824. The superior cardiac nerve of the left side has a similar origin to that of the right side, and presents the same disposition in the greater part of its extent. But it descends between the common carotid and subclavian arteries, near the origin of which it separates into a great number of filaments, which pass over the aorta to unite with those of the inferior cardiac nerve, or of the cardiac filaments of the pneumo-gastric nerve (1637). Some of them, slipping behind the aorta, join the cardiac ganglion.

2. OF THE MIDDLE CARDIAC NERVES.

1825. That of the right side is the largest of the three, which exist on that side. It arises internally and anteriorly from the middle cervical ganglion, by five or six filaments, at first united into two or three branches, and afterwards into a single trunk, which descends inwards near the common carotid artery, and passes before the subclavian, anastomosing with one or two filaments of the pneumo-gastric nerve. Beneath this vessel, it is joined by a twig of the recurrent nerve, glides before the inferior cardiac nerve, receives there two considerable filaments of the pneumo-gastric nerve, forms a kind of ganglion or bulging, and continues its course on the outer side of the brachio-cephalic artery. Lastly, between the arch of the aorta and the bifurcation of the trachea, it terminates in the cardiac ganglion.

Frequently the middle cardiac nerve divides in its course into two twigs, which again unite, and circumscribe a kind of *island*.

1826. The middle cardiac nerve of the left side receives its principal branch from the inferior cervical ganglion. It passes behind the subclavian artery, and directs itself obliquely forwards and downwards, running along its outer side. But towards the commencement of the inferior thyroid artery, a great number of twigs, which come from the middle cervical ganglion, and are repeatedly interlaced together, join this branch and form a second origin to the nerve, the latter then proceeds behind the arch of the aorta, receives several filaments from the pneumo-gastric nerve, and terminates in the cardiac ganglion without dividing, or by spreading out into several small twigs.

3. OF THE INFERIOR CARDIAC NERVE.

1827. On the right side, the filaments which are destined to compose it form, on leaving the inferior cervical ganglion, a kind of plexus which unites into larger twigs, which descend vertically behind the sub-clavian artery, close to the recurrent nerve. They direct themselves to the left along the brachio-cephalic trunk, run upon the anterior side of the arch of the aorta, and go between it and the pulmonary artery, to lose themselves in the anterior cardiac plexus.

1828. Most commonly, on the left side, the middle and inferior cardiac nerves are united into a single trunk (1826).

3. OF THE NERVOUS GANGLIA OF THE CHEST.

OF THE CARDIAC GANGLION OR PLEXUS.

1829. This is the central point of union of the cardiac nerves. It is placed behind the arch of the aorta, near the origin of that artery and before the division of the bronchi, and extends from above downwards, from the origin of the brachio-cephalic artery to the division of the pulmonary artery into two branches. It is elongated, sinuous, of an unequal size in the different parts of its course, and of a grayish colour. It has a transparent and gelatinous appearance, and its consistence is very soft. Its upper part receives the right and left middle cardiac nerves, some filaments of the superior cardiac nerves, especially of the left, and also some of the inferior cardiac nerves of the right side. But anteriorly, posteriorly, and inferiorly, it furnishes filaments which constitute various plexus which we proceed to examine, and into the formation of which there also enter numerous and isolated filaments of the inferior and superior cardiac nerves.

1830. Its *anterior filaments*, which are in very small number, are distributed to the walls of the fore part of the aorta. Some of them join the anterior plexus, beneath it.

1831. The *posterior filaments* are numerous. They are very short, and throw themselves into the fore part of the pulmonary plexus, (1640).

1832. The *inferior*, which are still more numerous and much larger, belong especially to the heart. They may be divided into two classes.

1. Some of them, collected into a pretty large bundle, and always pulpy and gelatinous like all the other twigs of this ganglion, embrace posteriorly the arterial ligament,* and turn from above down-

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* This *arterial ligament* is the remains of the ductus arteriosus which in the fœtus passed from the pulmonary artery to the aorta.

wards over the left pulmonary artery, where they begin to separate from each other. Several of them then penetrate into the lung, are interlaced with the divisions of the corresponding pulmonary plexus, and accompany the branches of the pulmonary arteries and veins. Others descend again upon the trunk of the pulmonary artery, as far as the heart.

But a much more remarkable twig than any of these, crosses obliquely from above downwards the left pulmonary artery, and gains the posterior part of the base of the heart, towards the origin of the posterior coronary artery. There it divides into a great number of very slender filaments which are interlaced around that artery, and form the *posterior coronary plexus.* These filaments, which are very numerous, give rise to as many secondary plexus as the vessel has branches. Thus one of these secondary plexus proceed from left to right over the base of the heart, and loses itself upon its plain surface. Another runs along the left edge of the heart, from the base of the pulmonary artery to the summit of the organ. A third, which is of smaller size, descends immediately behind the heart. Some of the filaments which constitute this plexus, separate and are distributed to the walls of the heart.

2. The filaments of the second class arise a little below the preceding, between the aorta and pulmonary artery. Some of them pass behind the latter and gain the posterior coronary plexus, which also receives others that have descended between the two vessels. But there are some which turn over the aorta, go to the fore part of the base of the heart, and constitute the *anterior coronary plexus* which is destined to accompany the artery of the same name.

This plexus, which is much smaller than the preceding, receives however the inferior cardiac nerve which belongs entirely to it. It is distributed upon the right auricle and the whole convex surface of the heart, anastomosing with the posterior towards the left edge of that organ.

OF THE THORACIC GANGLIA.

1833. Much smaller and less distinct than the cervical ganglia, they are twelve in number on each side, disposed in one and the same line, beneath the pleura, anteriorly to the head of each rib, or in the intercostal spaces. Their number may vary, however, there being often only eleven, because the first is confounded with the inferior cervical ganglion, (1816). The first ganglion, which is larger than the others, is placed at the outer side of the longus colli muscle. They are all firm, and of an oblong form, resembling grains of barley. They all communicate with each other by filaments which go from the lower part of the one to the upper part of the other, and moreover furnish external and internal filaments.

1. OF THE CONNECTING FILAMENTS.

1834. They are strong and of great size, frequently equalling the ganglia themselves in diameter, and are never multiple or ramified between two neighbouring ganglia. Their direction is not the same in all, their origin in each ganglion being more or less near the vertebral column. The intercostal arteries always pass behind them.

2. OF THE EXTERNAL FILAMENTS.

1835. Their number varies. Sometimes there is only one for each ganglion; but more commonly there are two and even four. In some cases, the single twig bifurcates. They all however proceed upwards and outwards, and, at the end of a short course, anastomose with each of the anterior branches of the dorsal nerves at the moment when they issue from the intervertebral holes. When several filaments proceed from the same ganglion, it is not rare to see them unite at the moment when the anastomosis takes place. The smaller filaments however lose themselves in the intercostal muscles.

3. OF THE INTERNAL FILAMENTS.

1836. Their number is considerable, and their distribution extremely variable. Some arise from all the ganglia which terminate in the interior of the chest; others, on the contrary, come only from the inferior ganglia and constitute the splanchnic nerves.

The former, which are very short and slender, become interlaced with each other at their very commencement, and go to the vertebral column. There, some of them are dispersed in the cellular tissue, while others join the pulmonary plexus of the pneumo-gastric. One of these filaments, which is longer and thicker than the others, comes from the tenth ganglion separate from the small splanchnic nerve, descends forwards, and goes to the fore part of the aorta, whose course it follows subdividing to infinity, and anastomosing with the corresponding filaments of the opposite side. This filament enters the abdomen and terminates in the cœliac plexus.

OF THE SPLANCHNIC NERVES.

1837. These nerves are two in number, and are distinguished into great and small. They are pretty regular in their occurrence and disposition. They arise from the last six thoracic ganglia, each of which furnishes internally a long white twig, the successive union of which produces two cylindrical cords which pass through the diaphragm and penetrate into the abdomen.

1. OF THE GREAT SPLANCHNIC NERVE.

1838. Its roots, to the number of four or five, and very distinct, come from the inner part of the sixth, seventh, eighth, ninth, and sometimes tenth thoracic ganglia. They all descend very obliquely inwards on the sides of the vertebral column and below the pleura, and unite into a single white and cylindrical trunk, opposite the eleventh dorsal vertebra. This trunk descends in the same direction, enters into the abdomen through a separation of the muscular fibres of the crura of the diaphragm, applied upon the vertebral column; passes behind the stomach, a little above the renal capsule, divides into several slightly divergent twigs, and almost immediately after terminates in the semilunar ganglion.

2. OF THE SMALL SPLANCHNIC NERVE.

1839. It is composed of two distinct twigs, coming from the tenth and eleventh thoracic ganglia, which directing themselves obliquely downwards and inwards, unite on the twelfth dorsal vertebra, into a small cord which perforates the diaphragm separately, penetrates into the abdomen, and divides into two twigs, one of which ascends to anastomose with the trunk of the great splanchnic nerve, while the other throws itself into the renal plexus and partly into the solar.

4. OF THE GANGLIA OF THE ABDOMEN.

OF THE SEMILUNAR GANGLIA AND SOLAR PLEXUS.

1840. The *Semilunar Ganglia*, of which there are two, one to the right and the other to the left, and which are of a much greater size than any that we have hitherto described, are oblong, sigmoid, concave above, convex below, and lie partly upon the crura of the diaphragm, partly upon the aorta, opposite the cœliac trunk, above the renal capsule and a little more backwards. By their upper and outer extremity, these ganglia manifestly receive the great splanchnic nerves, while by the lower, which is turned inwards, they communicate with each other, whether directly, which frequently happens, so that they form a single ganglion, or by a short twig of greater or less size, or a bundle of filaments. That of the right side is generally larger than the other, and frequently appears contracted in the middle. It is situated between the right pillar of the diaphragm and the vena cava abdominalis, near the head of the pancreas. It is also commonly in contact above with the renal capsule, and below with the corresponding renal artery. That of the left side is placed upon the left pillar of the diaphragm, and frequently covers the diaphragmatic artery, which evidently furnishes it with ramifications. The tail of the pancreas lies upon it. Its upper extremity is in contact with the splenic vein, and the lower with the left renal artery.

1841. The two semilunar ganglia, and especially the right, are surrounded by a multitude of other ganglia very distinct from each other, more or less voluminous, but varying as to number and form. They communicate with them by short filaments, which escape from all points of their circumference; and these secondary ganglia themselves send to each other and in all directions a multitude of small twigs, and even sometimes seem to be continuous with each other, leaving always between them areolæ more or less wide and irregular.

1842. It is this assemblage of ganglions and interlaced and anastomosing filaments that constitutes the *Solar Plexus.* This vast nervous network, lying upon the vertebral column, the aorta and the crura of the diaphragm, and concealed by the stomach anteriorly, by the liver and diaphragm above, and by the pancreas below, is so irregular in its form that an adequate idea of it cannot be conveyed in words. The ganglia and filaments of which it is composed are soft and reddish. It is strengthened by several twigs coming from the right pneumo-gastric nerve, and by some filaments only from the left. It appears essentially destined for the aorta, being distributed to all its divisions, and following its branches with a corresponding number of *secondary plexus*, which are as follows.

1. SUB-DIAPHRAGMATIC PLEXUS.

1843. They proceed from the upper part of the common plexus, and are destined to accompany the inferior diaphragmatic arteries. They are composed of only a very small number of filaments which run beside each other, without presenting the numerous anastomoses which we find in the other abdominal plexus. Some of them lose themselves in the fleshy fibres of the diaphragm. Others accompany the arterial twigs to a great distance; while several, especially to the right, anastomose with the phrenic nerves, (1667).

2. CŒLIAC PLEXUS.

1844. This is nothing else than an inferior prolongation of the solar plexus upon the tripod of the cœliac artery. It is a true continuation of it, and furnishes three very remarkable secondary plexus, which accompany the coronary artery of the stomach, and hepatic and splenic arteries. Many filaments of the phrenic and pneumo-gastric nerves especially terminate in it, and it also receives some from the last thoracic ganglion. It presents a considerable number of ganglia itself, which vary as to form and size.

1845. *Coronary Plexus of the Stomach.* Smaller than the two following, it embraces the artery near its origin by a circle of small ganglia. These ganglia, which are very numerous at first, become less frequent as they advance, so that at the place where the artery bends to gain the small curve of the stomach, the plexus is only composed of a few filaments. When it sends a branch to the liver, the plexus divides for the purpose of accompanying it; but more commonly it continues, without interruption, its course along the small curve of the stomach, spreading successively over the two surfaces of that viscus filaments which anastomose frequently with those of the pneumo-gastric nerves (1642). Near to the pylorus, the number of these filaments becomes much reduced. The upper join the hepatic plexus (1836), and the lower form a plexus which spreads out upon the fore part of the right gastro-epiploic artery.

1846. *Hepatic plexus.* This is much larger than the preceding. Belonging to the hepatic artery and vena portæ, it directs itself along with it towards the fissure of the liver, and divides, above the pylorus, into two portions.

The *inferior* gains the posterior side of the right gastro-epiploic artery, anastomoses with the filaments which the coronary plexus of the stomach sends before it (1845), and accompanies it in the manner of a nervous sheath. As it passes under the great curve of the stomach, there are detached from it numerous filaments which go to that viscus, while others penetrate into the pancreas along with the arteries which are distributed there, and some also go to the duodenum.

The *upper portion* of the hepatic plexus, which is much larger than the lower, presenting very small ganglia in its whole course, expands on arriving at the neck of the gall-bladder, which is surrounded on all sides by its interlaced filaments, without their being much prolonged upon the organ itself, in the walls of which a certain number of them are distributed. It forms a small secondary plexus around the pyloric artery, and thus communicates with the filaments which terminate the coronary plexus of the stomach above. Some of its ramifications accompany the ductus communis choledochus to the duodenum; but the greater number throw themselves into the substance of the liver along with the roots of the hepatic duct and the branches of the hepatic artery and vena portæ. In the fetus, some filaments of this portion of the plexus are united to the umbilical vein, and accompany it to the placenta.

The hepatic plexus receives numerous filaments of the termination of the right pneumo-gastric nerve; but it does not itself furnish all the nerves of the liver. The convex part of the right semilunar ganglion in fact sends directly to that viscus several filaments which pass under its small lobe, and form a plexus of themselves.

1847. *Splenic Plexus.* This is a compound of only a very small number of filaments, and is disproportionate to the size of the artery which it embraces. At its origin, it presents two or three pretty large ganglia, from which proceed filaments which run alongside of each other, without being interrupted by new ganglia, and anastomosing but very rarely with each other. Several of these filaments penetrate into the pancreas along with arterial twigs. The others wind round the splenic artery and enter with it into the spleen. But before this there are also given off by it some filaments which follow the course of the left gastro-epiploic artery, and are in part separately lost in the great epiploon. There are also observed some which accompany the vasa brevia.

3. SUPERIOR MESENTERIC PLEXUS.

1848. After forming the cœliac plexus, the solar plexus is still prolonged downwards over the aorta, until the moment when the superior mesenteric artery separates from it, and there forms a new network of very considerable size and interspersed with a few ganglia. This plexus descends along with the superior mesenteric artery between the pancreas and the transverse portion of the duodenum which receives filaments from it. It immediately expands and passes between the two laminæ of the mesentery, there forming a kind of web of very great extent, the meshes of which embrace the lymphatic ganglia of that region, and follow at the same time the twigs of the artery, so as to cover the whole surface of the small intestine. It also constantly sends off an isolated bundle of filaments which follow the right extremity of the pancreas, and are distributed to the duodenum along with two or three small arteries.

The superior mesenteric plexus, with the aid of the secondary plexus which it sends over, the middle colic and ileo-colic arteries, ascends into the mesocolon, and gives filaments to the ascending colon and cœcum.

All the filaments of this plexus are very flexuous, and frequently interrupted by ganglia. The latter are especially observed upon the edge of the intestine.

4. INFERIOR MESENTERIC PLEXUS.

1849. It is continuous above and before the abdominal aorta with the preceding, and receives at its commencement a great number of isolated twigs from the lumbar ganglia, and from the renal and spermatic plexus. It then goes to the inferior mesenteric artery, and forms around its origin a narrow sheath, much less complicated however than that of the superior mesenteric artery. It enters with it into the iliac mesocolon, and towards the edge of the pelvis divides into two portions. Of these portions, the *inner*, which is smaller, surrounds the common iliac artery, sends some straight and but seldom anastomosing twigs along the external iliac artery, and descends into the pelvis along with the hypogastric artery, of which all the branches thus receive a small plexus. It is also to be remarked that a great number of filaments of this plexus separate much from the vessels, to go before the sacrum to the hypogastric plexus; and that those which are applied upon the walls of the external iliac artery may be traced as far as the upper part of the thigh.

The other portion of the inferior mesenteric plexus, which is placed externally of the preceding, accompanies the mesenteric artery and its branches into the meso-rectum. Its filaments are interlaced around that artery in a very loose manner, and many of them are seen to separate and follow a vague direction in the different folds of the mesentery. Those which go to the sigmoid flexure of the colon are prolonged a little upon that intestine. The principal secondary plexus which may here be furnished is that of the left colic artery, which spreads out upon the corresponding portion of the colon, and goes to anastomose above with the superior mesenteric plexus.

Few ganglia are met with in the course of the inferior mesenteric plexus. When there are any, they are always situated near the principal artery.

5. RENAL OR EMULGENT PLEXUS.

1850. These are two in number, a right and a left. They come off along with bundles of the solar and cœliac plexus, from the outer part of the semilunar ganglia, and from the expansion of the small splanchnic nerves. They, moreover, join to themselves two other nerves of considerable size, one of which rises by two twigs from the eleventh and twelfth thoracic ganglia, and of which the other comes from the filament which connects the last thoracic ganglion with the first lumbar. Both pass through the diaphragm and anastomose together before losing themselves in the renal plexus. Frequently also the first two lumbar ganglia contribute to their formation.

Each of these plexus commences by three or four ganglia placed upon the commencement of the renal artery, and furnishing by their circumference a great number of slender rectilinear filaments, which do not anastomose with each other, but are interlaced in a decided manner, and join the different filaments which we have just described, at the moment when the artery separates into twigs.

There are then formed some small ganglia, particularly behind the renal artery or vein. Then also they all penetrate together into the substance of the kidney.

1851. Just at the commencement of the capsular arteries, there is detached from the renal plexus a small secondary plexus, (*Plexus Surrenal*, Chaussier,) which accompanies them, sends some filaments over the sides of the diaphragm, and joins itself to certain twigs of the semilunar ganglion.

6. SPERMATIC PLEXUS.

1852. These are also two, and are derived especially from the renal plexus. Formed by a small number of twigs, they follow the course of the spermatic arteries to the testicle in the male, and to the ovarium and Fallopian tube in the female; but it is impossible to say with certainty whether they penetrate the tissue of these organs. Two or three ganglia are observed in their course, and some filaments separate from them for the ureter.

OF THE LUMBAR GANGLIA.

1853. The *Lumbar Ganglia*, of which there are commonly five on each side, although sometimes only two or three, are of an oblong form and variable size. They occupy the space comprised between the twelfth rib and the articulation of the last vertebra with the sacrum, situated on the lateral and anterior parts of the body of the vertebræ, near the psoas magnus, behind the vena cava to the right, and the aorta to the left, and are more distinct from each other than the thoracic ganglia, and frequently larger on one side than on the other.

Their twigs, which are very white, are naturally distinguished into twigs communicating between the different ganglia, and into external and internal filaments.

1. COMMUNICATING TWIGS.

1854. They go from one ganglion to the other. Their form is often fasciculate, or they are united three or four together. Sometimes one or two are wanting, so that the communication is interrupted; or the two neighbouring ganglia are confounded and directly connected without their assistance. They are always very slender and of variable length, the ganglia themselves not occupying a very determinate place. The first connects the last thoracic ganglion with the first lumbar.

2. EXTERNAL FILAMENTS.

1855. Each ganglion commonly gives off two or three, either separately or by a common trunk. Pretty long and of great thickness, they cross the direction of the lumbar arteries before which they pass, or turn round them. Those belonging to the upper ganglia have a direction obliquely upwards; those of the middle ganglia, a transverse direction; and those from the lower ganglia pass obliquely downwards. They soon after pass between the slips by which the psoas muscle commences (809) to anastomose, opposite the intervertebral hole, with the anterior branches of the lumbar nerves.

Some more delicate filaments arise from these latter, or from the first, and lose themselves in the psoas magnus.

3. INTERNAL FILAMENTS.

1856. These filaments are numerous and very slender. They interlace frequently with each other, and form a very complicated net-work before the abdominal aorta. They are often intermingled with small ganglia.

This *aortic plexus* sends numerous filaments to the splenic, hepatic, renal, spermatic and mesenteric plexus, which we have already seen. It also sends some upon the common iliac and hypogastric arteries. Lastly, it is continued into the hypogastric plexus, which we shall presently examine. Some of those of the right side anastomose with those of the left side, passing under the aorta.

OF THE SACRAL GANGLIA.

1857. Of these there are three or four on each side. They lie upon the sides of the anterior surface of the sacrum, so much the nearer to the median line the lower they are, frequently occupying the orifice of the anterior sacral holes, covered by the peritoneum, and immersed in the adipose tissue of the pelvis. They vary in form and size. Their colour is pale, and their consistence soft. They all communicate together by filaments which are more or less long, and resemble those of the lumbar ganglia (1854). Moreover, the first almost always communicates with the last lumbar ganglion, Their filaments are distinguished into external, internal, and anterior. The latter contribute especially to form the hypogastric plexus.

1. EXTERNAL FILAMENTS.

1588. Pretty numerous, and of considerable thickness, but very short, these arise by fasciculi, and go to anastomose with the anterior branches of the sacral nerves (1736). Others are distributed to the pyramidalis and levator ani muscles.

2. INTERNAL FILAMENTS.

1859. Their number is indeterminate; those of one side anastomose with those of the opposite side upon the middle of the sacrum, where they form a kind of plexus.

3. HYPOGASTRIC PLEXUS.

1860. Formed by several filaments of the vesical, uterine, vaginal, and hæmorrhoidal nerves of the sciatic plexus (1763), by the end of the inferior mesenteric (1849) and aortic (1856) plexus, and by a considerable number of the anterior filaments of the sacral ganglia, the hypogastric plexus sends its ramifications to the rectum, bladder, vesiculæ seminales, uterus, vagina, and anus, along with the arteries which go to be distributed to these parts. Moreover, it also sends out of the pelvis, filaments which follow the arteries to the posterior region of the thigh.

1861. The last sacral ganglion emits from its inferior part filaments which direct themselves inwards to the anterior sacro-coccygeal ligament (622), where they unite with those of the opposite side, by means of a small ganglion, and forming an arch of which the convexity is directed downwards, and from which proceed some filaments which lose themselves on the anterior surface of the coccyx.

IV. OF THE ORGANS OF SENSATION IN PARTICULAR.

ARTICLE FIRST.

OF THE EYE AND ITS APPENDAGES, OR OF THE ORGAN OF VISION.

1862. The *Eyes*, *(Oculi,*)* are placed in the orbitar cavities, which we have already described, (342), while their appendages, *(oculi tutamina*, Hall), occupy the circumference of these fossæ, and consist of the eyebrows, eyelids, ciliæ, Meibomian glands, &c.

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[*] Οφθαλμος of the Greeks.

A. OF THE EYEBROWS.

1863. The *Eyebrows* or *Supercilia* are two arched eminences, convex above, differing in their degree of prominence, breadth, thickness, and elongation in different individuals, and generally larger in old people. They lie upon the superciliary arch of the frontal bone, (151), which forms their basis, extending above the eyelids, from the sides of the root of the nose to the temples. Their inner extremity or *head* is more prominent than the outer, which is named the *tail*, and which is slender and elongated. They are separated from each other by a greater or less interval in most subjects, but in many cases also they unite and are confounded above the root of the nose.

1864. The eyebrows are covered with short and stiff hairs directed obliquely outwards, much more numerous internally than externally, generally of the same colour as the hair of the head, and commonly thicker in dark than in fair persons. The portion of skin in which the bulbs of these hairs are implanted is pretty thick, and applied upon a layer of adipose cellular tissue which itself rests upon some fibres of the orbicularis palpebrarum and frontalis muscles, beneath which occurs the corrugator supercilii.

1865. The nerves of the eyebrows are furnished by the internal and external frontal nerves, (1582), and by a filament of the temporal branches of the facial nerve, (1613). Their arteries come from the ophthalmic and temporal arteries, and their veins pass into the corresponding venous trunks.

B. OF THE EYELIDS.

1. GENERAL CONFORMATION.

1866. The *Eyelids (Palpebræ,)* are two kinds of moveable veils lying upon the anterior part of the ball of the eye. They are separated above from the forehead by the eyebrow, and confounded below with the cheek, and are distinguished into *upper* and *lower*.

1867. The *Upper Eyelid*, which is very broad and possessed of great mobility, descends below the transverse diameter of the eye. It is chiefly by it that the eye is closed, for the lower eyelid does not rise high upon it. Both are convex before, and present a great number of transverse wrinkles, more numerous, however, on the upper than on the lower, and more distinct in old age than in youth. These wrinkles are semicircular and concentric, those on the upper eyelid are concave downwards, while those of the lower are concave upwards.

1868. The two eyelids are united at the extremities of the transverse diameter of the orbit, forming two angles, of which the inner is more open than the outer. This difference arises from the circumstance that the fibres of the orbicularis palpebrarum are inserted internally upon a tendon which does not exist at the outer angle (918). From the latter a number of wrinkles are seen to proceed in a radiating manner towards the temple.

1869. The free edges of both eyelids are in contact with each other, and supported by a fibro-cartilage. That of the upper eyelid is directed downwards, while the other looks upwards. They are cut obliquely from before backwards, and are so disposed as to form, on being brought together, a narrow and triangular canal, of which the ball of the eye constitutes the posterior wall. This canal is broader internally, especially opposite the puncta lachrymalia, than externally. It serves to conduct the tears towards these orifices during sleep.

The free edges of the eyelids are concave and rounded over an extent of two or three lines on the side next the nose, where they correspond to the caruncula lachrymalis. At the moment when they begin to be cut obliquely, there is observed a small tubercle in which is placed the orifice of the lachrymal ducts. There also they change their direction, become nearly straight when the eye is open, and present on the side next the eye, as far as the outer angle, a row of small holes which are the excretory orifices of the Meibomian glands, before which, near the skin, is a series of hairs which are named *Ciliæ.*

1870. The *Ciliæ*, which collectively are named the *Eye-lashes*, are hard and solid hairs, most commonly of the same tint as the hair of the head and eyebrows, sometimes, however, of a different colour, and arranged in two or three rows. They are more numerous, longer and stronger in the upper eyelid than in the lower, and their length is still greater at the middle of the edge where their bulbs are inserted than at its extremities. Those of the upper eyelid are at first directed downwards and then curved upwards. The reverse takes place in the lower. We have already said that they are entirely wanting between the puncta lachrymalia and the inner angle of the eye.

1871. The *Caruncula* Lachrymalis* is a small soft membranous tumour of a pale colour, placed in the inner angle of the eye behind the internal commissure of the eyelids. It is formed by a fold of the tunica conjunctiva, in the substance of which are observed mucous follicles and the bulbs of some very minute hairs.

2. ORGANIZATION OF THE EYELIDS.

1872. *Skin of the Eyelids.* It is distinguished from that of the other parts of the body by its extreme delicacy and its transparency, qualities which become more sensible towards the free edge of the eyelids. It is applied upon a layer of loose cellular tissue, with very slender filaments and compressed areolæ, never charged with fat, but capable of being filled with serosity with extreme facility.

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* Dimunitive of *Caro,* flesh.

1873. *Muscular Layer of the Eyelids.* It is formed by that portion of the orbicularis palpebrarum in which the fleshy fibres are as it were deprived of colour (918) and widely separated from each other. However, towards the free edge, they approach each other, so as to form a distinct bundle above the tarsal cartilage.

1874. *Fibrous Membrane of the Eyelids.* It exists behind the muscular layer, from which it is separated by a lamellar cellular tissue, and occupies only the external part of each eyelid. The portion which belongs to the upper eyelid is placed between the orbicularis muscle and the expanded aponeurosis of the levator palpebræ; that of the lower eyelid is immediately applied upon the tunica conjunctiva. These two portions have their fibres mutually interlaced from the angle of union of the tarsal cartilages to the outer angle of the orbit, and proceed from thence to the corresponding part of the circumference of that cavity, as well as to the edge of the cartilages, diminishing progressively in strength and thickness, so as to be internally replaced by a lamellar tissue loaded with fat. Apertures are observed in several places of it for the passage of nerves and vessels.

Moreover, the upper eyelid presents a second fibrous layer which crosses the direction of the above, and which is constituted by the aponeurosis of its levator muscle which attaches itself to the corresponding fibro-cartilage (923).

1875. *Tarsal Fibro-Cartilages.* These are two small laminæ placed in the substance of the free edge of each eyelid, on the same level as the fibrous layer. Each of them commences at the bifurcated extremity of the tendon of the orbicularis muscle (918), and terminates externally, by uniting with its fellow opposite the crossing of the two fibrous layers. They are much broader in the middle than at the extremities, and differ in their form as well as size. The *upper*, which is larger, is about six lines broad, and is very contracted at the two ends, while the *lower* is only about two lines in breadth, and presents nearly the same dimensions in its whole extent. Their *anterior surface* is convex, and is in connection with the orbicularis muscle; the *posterior* is concave, lined by the tunica conjunctiva, and marked with several vertical grooves, which lodge the Meibomian glands. Their adherent edge gives attachment to the fibrous layer of each eyelid; but in the upper eyelid it is strongly curved, and affords insertions to the levator muscle, while in the lower it appears rectilinear. Their *free* or *ciliary edge* is broad and thick, rounded, and slantingly cut (1869). These two fibro-cartilages are rather thin, very flexible, highly elastic, and of a slightly yellowish tint, but presenting nothing peculiar in their structure.

1876. *Meibomian Glands* or *Ciliary Follicles.* These are small round follicles, lodged in particular grooves, between the tarsal cartilages and the tunica conjunctiva. They are disposed one above another, in such a manner as to represent two vertical and parallel lines of a yellowish colour, sometimes straight, sometimes flexuous, sometimes ramified, more numerous and more distinct in the upper eyelid, where there are thirty or forty, than in the lower, where there are only about twenty. These which occupy the middle part are longer and narrower than those of the extremities. The intervals by which they are separated are larger in the upper eyelid than in the other, and towards their attached edge than towards the free edge. Each follicle is rounded, white or yellowish, hard, and pretty tenacious. They communicate with each other, and those nearest the free edge of each eyelid open externally by orifices which are scarcely perceptible, and which are disposed in one or two rows on the side next the eye, behind the ciliæ (1869). There issues from them a sebaceous humour, which, on pressing the tarsal cartilages, may be squeezed out under the form of extremely minute cylinders.

1877. The *arteries* of the eyelids are furnished by the ophthalmic, infra-orbitar, temporal and facial arteries. Their *veins* follow the same course, and pass into the corresponding trunks. Their *lymphatics*, which are very numerous, terminate, as well as those of the eyebrow, in the ganglia situated on the parotid gland and near the angle of the jaw. We have already described the *nervous filaments* which ramify in them, and which come chiefly from the lachrymal (1578), facial (1613), infra-orbitar (1590), frontal (1582) and nasal (1585) nerves.

C. OF THE TUNICA CONJUNCTIVA.

1878. The *Tunica Conjunctiva (Membrana adnata)*, belongs to the order of mucous membranes. It is very thin and transparent, and lines the posterior surface of the eyelids, and the fore part of the ball of the eye, being always limited at the circumference of the cornea, as has recently been demonstrated by Dr. Ribes.* On the free edge of the upper eyelid, it is obviously continuous with the skin, at the place where the ciliæ arise. It then covers the edge of the fibro-cartilage, and is perforated externally by the orifices of the ciliary follicles. Internally, it introduces itself by the superior punctum lachrymale into the lachrymal duct. From thence it is reflected over the sclerotica, to gain the posterior surface of the lower eyelid, and terminate upon its free edge, where it is continuous with the skin, and dives into the inferior lachrymal duct. In leaving the eyelids to be reflected over the eye, it forms a semicircular fold, which corresponds to the fat of the orbit.

1879. On the internal part of the ball of the eye, the tunica conjunctiva forms another rather indistinct fold, which is sometimes named the *Membrana nictitans*,* because in man it seems to be the rudiment of an organ of the same name which is highly developed in certain animals. This fold is semilunar or crescent-shaped. Its concave edge is directed outwards. It is rendered much more apparent by turning the eye from the nose.

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* *Bulletin de la Faculté de Médicine.* 1814. N. 4.

1800. The *inner surface* of the tunica conjunctiva is attached to the eyelids and ball of the eye by cellular tissue, which is very dense behind the tarsal cartilages, but rather loose everywhere else. The *outer surface* is smooth, not villous, and constantly moistened. When the eyelids are closed, it corresponds to itself in all points, when they are open, it is in part exposed to the contact of the air. This membrane contains a considerable number of capillary blood-vessels, especially on the eyelids. Its arteries are derived from the ophthalmic artery. The only nervous filaments which it appears to receive are very minute, and are supplied by the lachrymal nerve (1580), and external nasal (1585). I have in vain searched for those which are said to be sent to it by the external motor and pathetic nerves.

D. OF THE BALL OF THE EYE IN GENERAL.

1881. Situated at the inner and somewhat anterior part of the orbit, more or less prominent in different individuals, but always of about the same volume, the ball of the eye has the form of a spheroid, of which the greatest diameter extends from before backwards. Slightly depressed above, below and on the sides, it presents at its middle and anterior part a greater convexity than in the other parts of its periphery, and which is more distinct in young subjects than n old persons.

The antero-posterior diameter of the eye has an extent of from ten to eleven lines in the adult. Its other diameters are about a ine less. In general also it presents smaller dimensions in the female than in the male.

The direction of the eye is not the same as that of the orbit. Its axis is parallel to that of the other eye, while the axis of the orbit nclines inwards (350). There results from this arrangement that he optic nerve, which is directed inwards, is inserted into the inner side of the eye, and not into its middle part.

Viewed in profile, the eye appears composed of two distinct portions of a sphere united to each other, and of different diameters. The nterior segment, which forms about the fifth of the ball, has the smallest diameter.

Anteriorly, the eye is covered in a great part by the tunica conunctiva; posteriorly, and in its whole contour, it corresponds to he recti and obliqui muscles which terminate upon it, to a great umber of nerves and vessels, and to the soft and half fluid fat which fills up all the vacuities of the orbit. Superiorly and externally, the lachrymal gland rests upon it; inferiorly and internally, the caruncula lachrymalis is placed in its neighbourhood.

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* This fold is considered by most comparative anatomists as the rudiment of the hird or vertical eyelid so highly developed in birds. K.

The ball of the eye is moved by six muscles which we have already described (932).

E. OF THE PARTS WHICH ENTER INTO THE COMPOSITION OF THE BALL OF THE EYE.

1822. The parts which enter into the composition of the ball of the eye are membranes, as the sclerotica, cornea, choroides, retina, iris, hyaloid membrane, &c.; or fluids, as the aqueous and vitreous humours; or, lastly, bodies of a peculiar nature, as the crystalline lens and the ciliary circle. Nerves and vessels are also met within it. We proceed to examine these different constituent parts in succession.

1. OF THE SCLEROTICA.

1883. The *Sclerotica** *(Cornea Opaca)*, is a hard, opaque, tough substance, of a pearly white colour, occupying about four-fifths o the ball of the eye, and having the form of a sphere truncated anteriorly. It is of a fibrous structure, and is the strongest and mos external of the membranes of the eye. Its thickness becomes less th more anteriorly it is examined. Near the entrance of the optic nerv it is a line, whereas in the vicinity of the cornea it is no more tha the third of a line, but here it is strengthened by the expansion o the aponeuroses of the recti and obliqui muscles which seem to b identified with it, and which some authors have designated unde the name of *Tunica albuginea.*

1884. The *outer surface* of the sclerotica has the same relations as the ball of the eye itself; the *inner* is lined by the choroi membrane, with which it is freely connected by nervous filaments vessels, and a very delicate lamellar tissue of a peculiar natur These too surfaces present, in various points of their extent, principally at the back part, small holes for the passage of the ciliar vessels and nerves. These holes are the orifices of canals runnin obliquely in the substance of the membrane, and continuing anteriorly upon its inner surface in the form of slight grooves.

Behind and a little inwards, the sclerotica is perforated with rounded aperture for the passage of the optic nerve (1561.) Sometimes, in place of a single aperture, there is a multitude of smal holes, among which are observed one or two larger than the rest which belong to the central artery and vein of the retina. It i there that the continuity of the membrane with the sheath whic the dura mater furnishes to the optic nerve, is manifestly seen. Anteriorly, the sclerotica presents a circular aperture, the diameter of which is about six lines, somewhat larger however transversely than from above downwards, and whose circumference, which is sloped at the expense of the inner surface, receives the cornea like a case.

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* Σκληρὸς, *durus, crassus.*

1885. In the adult, the sclerotica is only formed of a single lamina, the fibres of which are so interlaced that it is difficult to distinguish them. Although at first sight no organization is discernible in it, it is shown by maceration to be in reality composed of fibrous filaments and small laminæ intermingled in an irregular manner. It contains very few blood-vessels, and those which it has are capillary. No nerves or lymphatics have as yet been discovered in it. In the eye of the fetus only, the sclerotica may be separated into two distinct laminæ. Some anatomists have supposed its inner lamina to be a prolongation of the pia mater; but this opinion appears to have no foundation.

2. OF THE CORNEA.

1886. The *Cornea*, *(Cornea Pellucida)*, which is of a nearly circular form, convex anteriorly, transparent, and constituting the anterior fifth of the eye, is cased in the great aperture of the sclerotica (1884), and presents the appearance of a segment of a smaller sphere added to a larger, and whose diameter is seven or seven and a half lines, while the chord of the segment itself is five lines.

The transverse diameter of the cornea is a little larger than the vertical. It is also a little broader on the side next the nose than on the opposite side.

Its *anterior surface*, which is convex and prominent, is covered by a kind of peculiar mucous layer, distinct from the conjunctiva, and itself defended by an epidermis of its own. The *posterior surface* is lined by the aqueous humour, and limits the anterior chamber of the eye, a space comprised between the iris and cornea. The *circumference* of the cornea, which is cut obliquely at the expense of its outer surface, is covered by a corresponding slope on the edge of the sclerotica, and adheres intimately to it.

1887. The cornea is thicker than the sclerotica, but it is not fibrous. Its tissue is composed of six distinct laminæ, superimposed upon each other, easily separable, and of which the anterior seem to adhere less intimately. It does not appear to contain either nerves or blood-vessels; but there evidently exists a serous fluid between the laminæ which compose it, and on squeezing the membrane, this serum is distinctly seen to ooze out in the form of small drops. It becomes opaque when immersed in boiling water, alcohol or an acid.

3. OF THE CHOROID MEMBRANE.

1838. The *Choroid* Membrane (Chorioïdes)* is of a dark brown colour, thin, soft, essentially cellular and vascular, and lies upon the internal surface of the sclerotica, from the aperture of the optic nerve to the ciliary circle. Its outer surface is united to the sclerotica, posteriorly, by vessels, nerves, and loose and very delicate laminated cellular tissue; anteriorly, by the ciliary circle. Internally, it is merely contiguous to the retina, to which it does not in any way adhere. Posteriorly, it presents for the optic nerve a narrow aperture, the circumference of which presents a prominent rim, which is not connected with the nerve, so that no continuity can be here supposed with the pia mater, as some anatomists have alleged to take place. Anteriorly, it adheres strongly to the ciliary circle and processes.

1889. The *outer surface* of the choroid membrane is covered with a brownish substance, easily removed, and which is composed of an innumerable multitude of globules forming by their union an excessively delicate net work or membrane, and leaving the sclerotica, after death, tinged in a very distinct manner. The *inner surface* presents a similar layer, only more abundant and of a deeper colour, but which does not tinge the retina. At the backmost part, near the optic nerve, this substance is substituted by a whitish circle. The dark substance in question is named the *Pigmentum nigrum.* On macerating the choroid membrane for some time, its covering is detached; it becomes transparent, loses much of its natural colour, and is covered with villosities. Perhaps the exhalation of the dark fluid is due to these. Its colour resists the action of air and of various chemical reagents, as does that of China ink, and is more intense in the vicinity of the iris than any where else. From recent experiments of M. Michele Mondini, it would appear that the black colour of this substance is owing to oxide of iron, as on calcining the choroid membrane of an adult in a platina crucible, there were extracted from it particles of that metal which were attracted by the magnet.

1890. The choroid membrane has nowhere a fibrous structure; only, near its anterior aperture, there are seen some radiated striæ which commence the ciliary processes. It appears entirely composed of a multitude of arterial and venous vessels, united together by a very delicate cellular web. The arteries are principally distributed at its external surface; the veins at the internal. Posteriorly these vessels form two superimposed planes, which may be separated from each other; but this division does not take place anteriorly, although Ruysch appears to have discovered this structure, and although his son gave the name of *Membrana Ruyschiana* to the internal lamina. The most carefully made preparations do not disclose either glands or follicles in the choroid membrane; but M. Bauer has discovered lymphatics in it, which accompany the principal arteries.

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* *Χορίον secundæ seu chorion; εἶδος, forma;* from its being supposed to have some resemblance to the chorion which envelopes the fetus in the uterus.

4. OF THE CILIARY CIRCLE OR LIGAMENT.

1891. The *Ciliary Circle* or *Ligament (Orbiculus ciliaris*, Hall, *Ligamentum ciliare)* is a kind of grayish ring, pretty thick, particularly at its large circumference, about a line or two broad, situated between the choroid membrane, the iris, and the sclerotica, and adhering more to the first of these membranes than to the others. Its consistence is pulpy, and its tissue moistened by a whitish mucosity. It receives the last ramifications of the ciliary nerves, and sends others behind the iris, so that although its intimate structure is still unknown, it may to a certain degree be compared to a nervous ganglion* (1794). The iris is as it were encased in its small circumference, which forms a slight projection before it. Its great circumference is connected with the choroid membrane, and its posterior surface rests upon the ciliary processes. The ciliary circle is traversed by the long and anterior ciliary arteries, and receives some ramifications from them.

5. OF THE IRIS.†

1892. This membrane is a kind of septum placed vertically in the anterior part of the ball of the eye, in the midst of the aqueous humour. Circular and flat, it separates the *Anterior Chamber* of the eye (1886) from the *Posterior Chamber*, which is limited behind by the crystalline lens, and yet allows a free communication between them, because it presents an aperture at its middle part which is always free. This aperture of the iris is called the *Pupil (Pupilla)*, and has its centre nearer the inner than the outer extremity of the transverse diameter of the eye. During life, and from the effect of the alternate contraction and expansion of the iris, this aperture is continually varying in its dimensions. Its mean diameter is about a line.

Of the two chambers of the eye, the posterior is much narrower than the anterior; but it very certainly exists, although the contrary has been asserted. It is not more than a fourth of a line in depth, whereas the other is a line and a half at least; and it is only truly apparent toward the circumference of the crystalline hu-

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[*] The dissections of Zinn and Wrisberg, often repeated by myself, seem altogether to disprove this idea. K.

[†] This name is imposed upon it on account of the variety of colours which its anterior surface presents.

mour, the convexity of which gives it the form of a circular prism with three faces.

1893. The *anterior surface* of the iris is covered by the membrane of the aqueous humour, which however is only traced with much difficulty. It is differently coloured in different subjects, and presents two very distinct circular and concentric bands, an inner, near the pupil, and an outer, of which the former is narrower and deeper, the latter broader and less intensely coloured. In some cases, the colours of the iris are distributed in patches, which gives it a marbled appearance.

On this surface there are observed many prominent and radiated striæ, more or less flexuous, which, commencing at the great circumference of the iris, terminate at the pupil, where they bifurcate. Their number varies from seventy to eighty. They are much more distinct during life than after death. In their intervals there are many nerves and vessels, as well as very minute villosities.

1894. The *posterior surface* of the iris has sometimes received the name of *Uvea*, on account of a very thick and adherent black varnish which covers it, and which, in the intervals of the ciliary processes, is continuous with that of the inner surface of the choroid membrane (1889). This surface is in the most immediate connection with the ciliary processes, and when it has been wiped there is observed upon it a great number of straight, convergent, prominent lines, blending into a membranous zone near the pupil, and appearing to be the continuation of these small membranous bodies. There are also seen upon it numerous very distinct villosities.

1895. The *great circumference* of the iris corresponds from without inwards to the ciliary circle (1892), the choroid membrane and the ciliary processes. It may easily be detached from these various parts. Its *small circumference* forms the limits of the pupil.

1896. The iris is composed of two laminæ intimately united near the pupil, but which may be separated towards its great circumference. Several anatomists of great merit have admitted muscular fibres in the iris, and recently Dr. Maunoir, of Geneva, a very distinguished surgeon, seems to have confirmed their existence, which however is denied by most authors of our day. He discovered, by means of a strong lens, that these fibres form two kinds of planes; an outer, radiated, broader, corresponding to the outer coloured ring, and dilating the pupil; an inner, narrower, composed of circular fibres, corresponding to the inner coloured ring, and contracting the pupil in the manner of a *sphincter*. I have observed the disposition pointed out by M. Maunoir in the dead body, and M. Bauer has since confirmed it (November 1821), as well as Sir Everard Home.

1897. We have already described the nerves of the iris, (1792). Its arteries are furnished it by the long ciliary arteries. Its veins go to the vasa vorticosa of the choroid membrane and long ciliary veins. We shall speak of them afterwards.

1898. In the fetus, up to the seventh month of gestation, the pupil is closed by a grayish membrane, provided with very apparent blood vessels, much thinner than the iris, transparent, colourless, and disappearing towards the period of birth. It is named the *Membrana pupillaris*, after Wachendorf, who first discovered it in 1738. So long as the membrana pupillaris is entire, it forms with the iris a complete septum, which separates the two chambers of the eye, and prevents all communication between them. It is besides flat and attached to the whole circumference of the pupil, so as to be continued over the anterior surface of the iris.

The membrana pupillaris is evidently formed of two diaphanous laminæ placed back to back. The posterior belongs to the corresponding chamber of the eye, and arises from the circumference of the pupil. The anterior depends from the membrane of the aqueous humour which lines the posterior surface of the cornea, and the whole anterior chamber of the eye.*

6. OF THE CILIARY PROCESSES.

1899. The *Ciliary Processes (Processus Ciliares,)* are small vasculo-membranous prominent bodies, placed beside each other in a radiating manner, so as to form a ring like the disk of a radiated flower, which surrounds the crystalline lens in the manner of a crown placed behind the iris and the ciliary circle, in particular depressions of the fore part of the vitreous body. This ring, which results from the union of the ciliary processes, is called the *Ciliary Body.*

The number of ciliary processes varies from sixty to eighty, and is even frequently greater. Each of them is about a line and a half in length, but they are alternately longer and shorter. They are triangular, very pale and thin behind, becoming more prominent, thicker, and whiter before. Their *posterior* edge, which is concave, is received at the circumference of the crystalline lens into a groove of the vitreous body. The *anterior* is applied upon the ciliary circle and the iris. The *inner*, which is much shorter than the others, is free, and measures the space comprised between the crystalline lens and the posterior surface of the iris. It is denticulated. The angle by which it is terminated posteriorly does not adhere to the capsule of the lens, but the anterior angle is connected with the iris by cellular filaments and vessels. There proceed from it straight lines which converge towards the pupil on the posterior surface of that membrane, (1894).

By their posterior extremity, the ciliary processes separate in a diverging manner, and are prolonged under the form of striæ immersed in the choroidal fluid and applied upon the vitreous body, so as to leave blank traces on the hyaloid membrane, or rather on the retina, when they are raised. These striæ are always multiple for each ciliary process, and constantly correspond to the intervals of these laminæ.*

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* Jules Cloquet, *Memoire sur la Membrane pupillaire.* Paris, 1818, 8vo. with figures. The admirable memoir of Dr. William Hunter on the *membrana pupillaris* left nothing to be desired on this subject.

The ciliary body, consisting of the united ciliary processes, therefore terminates posteriorly by a dentated and undulated edge, equally black in its whole extent; anteriorly it presents lines which are the ciliary processes themselves, separated by dark intervals.

The surface of the ciliary processes is reticulated and villous. They receive almost as many vessels of themselves as all the other parts of the eye together. Dr. Ribes thinks they are destined for the reproduction of the humours of that organ †; their arteries come from the short ciliary arteries. Their veins empty themselves into the vasa vorticosa of the choroid membrane. No lymphatics have as yet been detected in them.

The intervals which exist between these laminæ are filled with a blackish tenacious substance, which resembles that on the inner surface of the choroid membrane, and which also serves to unite them to the anterior part of the vitreous body. Sir Everard Home mentions his having found in these intervals, bundles of muscular fibres, arising circularly from the hyaloid membrane, passing over the edges of the lens, and terminating at its capsule, without having any connections, either with the ciliary processes, or the iris. I have not yet succeeded in discovering them, although I have made a great many dissections for the purpose.

7. OF THE RETINA.

1900. The *retina* is a soft, pulpy membrane of a grayish colour, transparent, and extremely thin, extended from the optic nerve to the crystalline lens, embracing the vitreous body, and lining the choroid membrane, without contracting any adhesion to these two parts. It commences posteriorly around a small tubercle formed by the extremity of the optic nerve (1562), but does not at all appear to result from its expansion. The optic nerve, in fact, says M. Ribes, is distributed in the retina, as the olfactory and acoustic nerves in the pituitary membrane and membrane of the labyrinth.* Besides, the tint of these two organs is altogether different.

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* The author has omitted to describe the zonule of Zinn, or rather, in the foregoing paragraph, he has totally mistaken the connection between the coloured and colourless parts of the eye; we may here briefly observe, that the pretended striæ, seen on the surface of the vitreous body, and which have usually been described as impressions left by the ciliary processes, are not mere makings, but a very complicated structure. On that part of the hyaloid membrane on which the ciliary processes rest we find an equal number of folds or laminæ, which, projecting outwards, are dove-tailed as it were with the ciliary processes. These membranous folds are vascular, the vessels pass in great numbers from the ciliary processes to them, and these vessels, together with the dove-tailing of the two sets of processes, form, as every anatomist ought to know, the bond of union between the choroid and hyaloid membranes, which otherwise would have no connection with each other. The student is referred for a more particular account of the structure of the eye to the Transactions of the Royal Society of Edinburgh, vol. x. part 1st, and following.—K.

† *Bulletin de la Faculte de Medicine*, loco cit. This opinion is contrary to that of Haller, who supposed them intended for keeping the crystalline lens in its place, and to those of many other anatomists who consider them as destined for the motions of the iris, or the protraction of the lens.

At the level of the ciliary processes, the retina forms a kind of somewhat thicker rim, from which proceeds an excessively delicate and pulpy lamina, which is reflected over these small bodies, sinks into their intervals, and arrives at the crystalline lens. It is this substance which, between the ciliary processes, is tinged by the pigmentum nigrum.

1901. At about two lines distance from the optic nerve, and to the outside of it, there is perceived, on the inner surface of the retina, a spot of a yellow colour, pretty deep in adults, paler in children and old people. This spot is about a line broad, and is placed exactly in the direction of the axis of the eye. It is surrounded by several folds, of which one only appears to be constant, and in its centre is observed an irregular and very narrow hole. These different circumstances were discovered by Soemmering in 1791.†

1902. The retina appears formed of two laminæ which are parallel to each other, and so closely united as to be almost inseparable. The *outer* of these laminæ is medullary, pulpy or mucous, and is partly detached by maceration. The *inner*, is fibro-vascular, firmer, and serves to support the outer. It has been named the *tunica vasculosa retinæ* by some anatomists. It is in the latter especially that the central artery of the optic nerve expands, constituting the only known means of union between the retina and the other parts of the globe of the eye.

8. OF THE AQUEOUS HUMOUR AND ITS MEMBRANE.

1903. The *Aqueous Humour* is a limpid and transparent fluid, which fills the two chambers of the eye, from the cornea to the crystalline lens, so that, as we have already said, it is in contact with the two surfaces of the iris. Its quantity is from five to six grains at the most. It is slightly viscous, like water holding a little gum in solution. Submitted to the action of caloric, it however leaves no residuum; it is not coagulated either by acids or by alcohol, only nitric acid renders it a little turbid. Its specific gravity, according to Chenevix, is 1.0003. The same chemist admits in it the presence of gelatin, albumen and hydrochlorate of deutoxide of sodium. M. Nicolas to these adds phosphate of lime. All these principles are suspended in an immense quantity of water. Left to itself, it quickly putrefies. During life, it is reproduced with the greatest facility, when its removal has been effected by any cause.

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* The examination of the retina under the microscope by Dr. Brewster and myself disproved very forcibly in our minds these opinions of M. Ribes.—K.

† I disproved some years ago the constancy of this fold, and showed it to be a post-mortem appearance. The foramen of the retina, which was discovered by Soemmering, affects only the outer or pulpy layer of the retina. It was supposed by its distinguished discoverer to be peculiar to the human race, but it was soon after shown, by Michaelis, to be present in the quadrumana, and by myself it was discovered in the chameleon, and in certain lizards: for a full account of this discovery the student is referred to the Transactions of the Wernerian Society, vol. v. part 1st, and to those of the Royal Society of Edinburgh, vol. x. part 1st.—K.

In fetuses and newly-born children, this humour has a reddish tint, which is dissipated about a month after birth. In some old persons, it naturally loses a part of its transparency.

1904. The membrane of the aqueous humour is very thin, perfectly translucid, and very difficult to be distinguished. It lines all the walls of the anterior chamber of the eye, and is perforated at the level of the pupil. In embryos, it forms a serous bag without aperture, on account of the existence of the membrana pupillaris (1898). In no case does it penetrate into the posterior chamber. By ebullition it is easily separated from the posterior surface of the cornea (1886). It was discovered in the last century by Demours and Descemet, although Zinn would appear to have spoke of it before them.

1905. Some authors assert that this membrane is not destined for the exhalation of the aqueous humour, alleging that it is brought into the chambers of the eye by particular ducts. This was the opinion of Nuck, Ruysch, and Santorini, which others have regarded as unfounded.

9. OF THE CRYSTALLINE LENS AND ITS MEMBRANE.

1906. The *Crystalline** *Lens* is a transparent body, of a lenticular form in the adult, nearly spherical in the fetus, placed between the aqueous humour and the vitreous body, at the meeting of the two posterior thirds of the eye with its anterior third. It axis, which corresponds to the centre of the pupil (1892), approaches the nose a little. Its diameter is four lines, and it thickness about two.

Its *anterior surface*, which is bathed by the aqueous humour o the posterior chamber of the eye, is convex and free in its whol extent, presenting a segment of a sphere of much smaller diamete than that which the vitreous body represents. It is separated fro the iris and ciliary processes by the posterior chamber of the ey (1892). It is always less convex than the *posterior surfac* which is received in a particular cavity of the vitreous humou

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* Κρυσταλλος, *crystallus.*

The circumference of the crystalline lens is more firmly attached to the vitreous body than its posterior surface.

1907. The crystalline lens, which is perfectly transparent in the adult, is a little reddish in the fetus, and yellowish in old persons. Its softness diminishes in the direct ratio of the age. In children, it is entirely pulpy; but in grown up persons, it appears composed of two very different layers, an external and a central. The former, which is pretty thick, is soft and easily removed; the other constitutes a kind of solid nucleus formed of a great number of concentric superimposed laminæ. Each of these laminæ itself appears to present concentric fibres when the lens has been exposed to the action of certain reagents. Some of these fibres detach themselves from one lamina to go to the next, and are thus the only means by which they are united together. The number of these laminæ is indeterminate.

We also observe that the crystalline lens may be very easily divided into three pretty regular segments of a sphere, at the centre of which there exists a very small transparent globule.

1908. Chenevix has found that the specific gravity of the human lens is 1.0790. He thinks that it differs chemically from the aqueous humour only in having a larger proportion of gelatin and albumen, and in the absence of saline matters. It entirely loses its transparency through the action of caloric and after being boiled in water, as well as by desiccation. It putrifies under long maceration.

1909. It is not yet determined whether the lens has blood vessels or not. It appears probable that the arterial ramifications are limited to its membrane. It is also pretty certain that it receives no nerves.

1910. The *Membrane* or *Capsule* of the lens has a form similar to that of the body which it contains. It represents a sort of sac without aperture, which sends no prolongation into its interior, and which is itself lodged in a reduplication of the hyaloid membrane, from which it may very easily be separated at the edges; but, anteriorly and at the middle, these two membranes are entirely confounded. By its inner surface it has no adhesion to the lens itself.

At the place where the anterior and posterior portions of this capsule unite, there is perceived a series of transverse slits which occupy its whole circumference.

The capsule of the lens is much thicker and denser than the hyaloid membrane. It even seems, according to Haller's observation, to have some similarity of structure to the cornea; a disposition which is especially manifest in its anterior half, for in the posterior it is much thinner. By the action of caloric and of boiling in water, it hardens and assumes a milky tint, which also happens when it is immersed in acids. On being dried in the open air, it becomes yellowish. Its intimate texture is little known. It receives posteriorly a small branch of the central artery of the retina;

and anteriorly some ramifications of the vessels of the ciliary processes. Its veins and nerves are unknown.

1911. The crystalline lens is fixed and kept in its place by very numerous delicate, fascicular, transparent filaments, of a peculiar nature, which pass from the intervals of the ciliary processes to the circumference of the capsule of the lens.

1912. Between the lens and its membrane occurs the *Liquor Morgagni*, a kind of peculiar transparent, slightly viscous fluid, existing in small quantity, and escaping the moment the capsule is opened.[*]

10. OF THE VITREOUS BODY AND HYALOID MEMBRANE.[†]

1913. The *Vitreous Body* is a soft, perfectly transparent, tremulous mass, occupying the three posterior fourths of the cavity of the ball of the eye. It has a spherical form, but presents a very distinct depression at its fore part for lodging the crystalline lens. It is invested in nearly its whole extent by the retina, with which it contracts no adhesion, so that it is connected with the rest of the eye only by the middle branch of the central artery of the optic nerve, which passes through it to ramify in the posterior half of the capsule of the lens.[‡] Its translucency and limpidity experience no alteration from the advance of age; but in the fetus it has a reddish tint.

The vitreous body is composed of two distinct parts, the vitreous humour and the hyaloid membrane.

1914. The *Vitreous Humour* mingles readily with water, and has the appearance of a solution of gum in that fluid. It is not coagulated by boiling, only it receives a slight opaline tint, an effect which alcohol and concentrated acids also produce upon it. M. Nicolas found its specific gravity to be 1.0009. It is consequently a little denser than the aqueous humour: but it appears, in a chemical point of view, to contain the same principles as it (1903). On leaving it exposed to the air, it equally putrefies.

The quantity of this humour is proportional to the volume of the vitreous body. It is not less than 100 grains, and frequently exceeds that number.

1915. The *Hyaloid Membrane*, which is excessively thin and transparent, constitutes a mass of cellules of a form and size which it is very difficult to determine, and in which the vitreous humour is contained. They all communicate together, so that by making a single aperture in the hyaloid membrane, the whole humour may be drained off.

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[*] Many anatomists consider this *liquor* as a *post-mortem* appearance.—K.

[†] Υαλος, *vitrum* ; ειδος, *figura.*

[‡] See this statement corrected at page 552, *note* *.

At the entrance of the optic nerve into the eye, the hyaloid membrane is reflected upon itself to form a canal which passes directly through the vitreous body from behind forwards.

At the level of the ciliary processes, towards the circumference of the crystalline lens, this membrane divides into two laminæ, one of which passes before the capsule of that body while the other lines the concavity which receives it behind. There results from their separation a space of the form of a three-sided circular prism, completed by the circumference of the lens. It is this empty space that is called the *Canal of Petit.* It is broader on the side next the temple than towards the nose, and its existence may be easily demonstrated by insufflation. The two laminæ which form it are in perfect contact. The anterior presents striæ corresponding to the ciliary processes, and is equally traversed by radiating bridles, which make it appear bagged when the canal is distended, and as if composed of a row of canals placed at regular intervals.

1917. The structure of the hyaloid membrane is yet little known. It receives branches from the central artery of the retina. It becomes crisped by the action of heat and by that of concentrated acids.

1918. No part of this membrane is so dense and so thick as the portion which forms the hollow destined for the reception of the crystalline lens. No adhesion exists in this part between the hyaloid membrane and that of the lens. They are equally smooth, and their contact is maintained by a kind of dew which lubricates their surfaces.*

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* The above description of the formation of the canal of Petit is incorrect, and, moreover, in some points, unintelligible. The student is referred to a memoir on this subject in the Transactions of the Royal Society of Edinburgh, vol. x. part 2; and the following brief description of these parts, extracted from the memoir alluded to, may perhaps be found useful, and enable the student to dissect those parts for himself.

Near the point where the zonule of Zinn commences, and where the pulpy portion of the retina ceases, there is detached a delicate colourless membrane over the whole anterior concave surface of the vitreous humour, and which, as is very correctly stated in anatomical works, is merely contiguous to the posterior surface of the capsule of the lens, but is not in any way connected with it. This contiguity I perceived to be constant, by reason, probably, of the elasticity of the membranes I am next to describe, viz. those immediately forming the canal of Petit.

After the layer of the hyaloid membrane which invests the anterior aspect of the vitreous humour has been detached, the remaining structure passes on towards the equatorial margin of the lens; but, previous to being fixed into its capsule, it alters very much in appearance, and assumes a structure I have already often described. It divides into two distinct layers; the external or outer, constituting the internal ciliary processes, and an inner membrane, also vascular, separating the canal of Petit from a cavity, which may be formed artificially, by blowing in air betwixt the posterior surface of the capsule of the lens, and the hyaloid membrane on which this rests. Just as the membranes forming the canal of Petit are about to reunite, they adhere firmly to the capsule of the lens, and seem to transmit another very delicate membrane, closely investing the posterior surface of that capsule. This is the whole mechanism of the canal.

ARTICLE SECOND.

OF THE EAR AND ITS APPENDAGES, OR THE ORGAN OF HEARING.

A. *OF THE EXTERNAL EAR.*

1. *Of the Auricle.*

a. GENERAL CONFORMATION.

1919. The *Auricle (Pinna Auriculæ)* occupies on either side the lateral part of the head, behind the cheeks, beneath the temple, and before the mastoid process. Its size varies in different individuals, as well as its form, which is very irregular, but which may yet be compared in a general manner to that of an oval having its greatest diameter vertical and its large extremity directed upwards. Curved in various directions, and compressed from without inwards, it is free above, below and behind; but before and internally it is continuous with the neighbouring parts.

1920. The *external surface* of the auricle, which is commonly turned a little forwards, presents several remarkable prominences and depressions, which are from above downwards, as follows.

1. The *Helix*, a kind of replication or rim of a nearly semicircular form, which commences towards the middle of the auricle, above the meatus auditorius, and at the centre of the concha. It directs itself at first forwards, then upwards, and curves backwards to descend at the back part of the circumference of the auricle, which is thus in a great measure surrounded by it. It is narrow and not very prominent at its extremities, but presents a remarkable breadth at its middle part. Its inferior extremity, which seems bifurcated, is continuous anteriorly with another eminence named the *anti-helix*, and posteriorly with the lobe of the ear, of which we shall presently speak.

2. The *Groove of the Helix*, more or less deep and narrow, which commences in the concha, follows the whole course of the helix within and beneath it, and terminates towards the anterior branch of its inferior bifurcation.

3. The *Anti-helix*, an eminence which commences in the groove of the helix, above the concha, by a bifurcated extremity, of which one of the branches is superior, broad, obtuse and oblique, and the other inferior, narrow, more prominent and horizontal. They afterwards unite to form a single prominence, thicker but shorter than the helix, which describes a curve whose concavity is turned

forwards and downwards, and terminates, becoming thinner, behind and above the anti-tragus, from which it is separated by a slight notch.

4. The *Fossa navicularis* or *scaphoides*, the superficial depression which separates the two roots of the anti-helix.

5. The *Tragus*, a kind of small mammillary eminence, placed before the orifice of the auditory canal, which it seems to conceal. Its form is flat and irregularly triangular. Its base is continuous above and below with the rest of the auricle. Its summit is directed backwards and outwards. Its outer edge is separated from the commencement of the helix by a notch.

6. The *Anti-tragus*, another mammillary eminence smaller than the preceding, situated opposite to it behind, and beneath the anti-helix. It is conical, and its summit is turned upwards and forwards.

7. The *Concha*, a deep cavity, limited behind by the anti-helix, divided into two unequal portions by the helix, limited before by the tragus, and below by the anti-tragus. Its upper portion, which is narrower and transversely elongated, is continuous with the groove of the helix. The lower portion, which is broader and of a somewhat triangular form, is continuous anteriorly and internally with the meatus auditorius.

8. The *Lobule* or *Lobe of the Ear*, a soft rounded eminence, of variable size, which terminates inferiorly the circumference of the auricle, and which it is customary in some countries to perforate, for the purpose of suspending rings to it.

1921. The *Inner Surface* of the auricle is inclined backwards. It presents eminences and cavities the reverse of those observed on the outer surface, with the exception of the tragus and anti-tragus, which have nothing to correspond with them here. Free in a great part of its extent and separated from the head by a greater or less interval, it is continuous anteriorly with the temporal region.

6. ORGANIZATION OF THE AURICLE.

1922. *Of the Dermal Layer.* The skin of this region presents a great degree of thinness, particularly upon the different folds. Having a great number of sebaceous follicles dispersed through it, it adheres pretty firmly to the fibro-cartilage, from which it is separated by a dense cellular tissue, which scarcely contains any fat, and it forms the lobe of itself. The latter is besides filled with a mass of very fine fat, contained in very narrow cellules. At the summit and on the inner surface of the tragus, it is furnished with hairs which vary in length and number in different subjects. They appear destined to prevent the introduction of the small bodies which float in the atmosphere into the ear.

1923. *Of the Fibro-cartilage of the Auricle.* It constitutes the basis of the external ear, determining the forms of that part by its elasticity and consistence. All the eminences and cavities which we have described above are seen upon it, with this difference, that they are much more distinct than when it is covered by the skin. It presents, moreover, a slight prominence on the helix, above the tragus, and, between these two parts, it is intersected by a fissure which is filled up by a ligament, so that the portion which belongs to the tragus is separated from the rest. It experiences a similar interruption, or presents a similar fissure, between the anti-tragus and the united extremities of the helix and anti-helix, which is in like manner filled with a fibrous substance. Inferiorly, this fibro-cartilage is not prolonged in any shape into the lobe; but internally it is continuous with the auditory canal, as we shall afterwards describe.

This fibro-cartilage, which is analogous to those of the wings of the nose, the trachea, &c. has a very delicate tissue, a yellowish white colour, and a great degree of flexibility. It is covered by a perichondrium, and perforated by several apertures for the passage of blood-vessels.

1924. *Of the Ligaments of the Auricle.* These ligaments, which serve to fix the fibro-cartilage to the lateral part of the head, are three in number, a superior, an anterior, and a posterior. The *superior ligament*, which is attached behind the concha, to the upper part of the convexity which it presents in that direction, terminates by expanding in the epicranial aponeurosis. The *anterior* proceeds from the base of the tragus, and from the neighbouring region of the helix, to be inserted into the zygomatic process, above the temporo-maxillary articulation. The *posterior* goes from the convexity of the concha to be inserted at the base of the mastoid process. They are all rather cellular than fibrous, and are a little intermingled with the fleshy fibres of the auricular region (900).

1925. *Of the Muscles of the Auricle.* They are of two kinds. Some, which have already been described, are subservient to the general motions of the part. The others, of which we proceed to speak, are placed in different points of the auricle, upon its fibro-cartilage. They are always of small size; one or more of them are sometimes wanting; and sometimes, none at all are met with. They determine the partial motions of approximation and separation between the different regions of the organ. They are commonly five in number, and are designated as follows.

1. *Muscle of the Tragus*, or *Tragicus.* Pretty broad, very apparent, more constant than the others, and of a triangular form, it almost entirely covers the outer surface of the tragus, arising from the base and terminating at the summit of that eminence.

2. *Muscle of the Anti-tragus*, or *Anti-tragicus.* Less broad, but thicker than the preceding, and of as constant occurrence, it occupies the interval which separates the anti-tragus from the anti-helix. Its fibres are oblique. Anteriorly, it is covered by the fibrous layer of which we have spoken (1923), and posteriorly corresponds to the skin.

3. *Large Muscle of the Helix.* Long and slender, it covers

for the space of a few lines the origin of the helix above the tragus. It is directed obliquely forwards, and is thinner anteriorly than posteriorly.

4. *Small Muscle of the Helix.* Very thin, and commonly wanting, it is much more slender than the preceding, and is situated beneath and behind it, on the prominence of the helix which divides the concha into two parts.

5. *Transverse Muscle*, or *Transversus Auriculæ.* Placed behind the auricle, it arises from the convexity of the concha, and loses itself upon the prominence which the groove of the helix forms posteriorly. It is frequently divided into three or four distinct fasciculi.

2. *Of the Meatus auditorius externus, or Auditory Canal.*

a. GENERAL CONFORMATION.

1926. Placed between the tempero-maxillary articulation and the mastoid process, this canal extends from the bottom of the concha to the cavity of the tympanum, from which it is separated by the membrana tympani. Its length, which is about ten or twelve lines in the adult, is always a little greater below than above. It is directed obliquely from without inwards and from behind forwards; but it is curved in the direction of its length so as to present a convexity above and a concavity beneath. Broader at its extremities than at the middle part, its transverse section is of an elliptical form. Its inner extremity is limited by the membrana tympani, and it is upon this that the greater extent of its lower wall depends.

b. ORGANIZATION.

1927. The meatus auditorius is formed by a bony portion which belongs to the temporal bone, by a prolongation of the fibro-cartilage of the concha, and by a kind of fibrous membrane. The skin of the auricle is continued into its anterior, and lines it. Its *bony portion* has already been described (1172); we shall therefore pass to the other parts which enter into its composition.

1928. *Of the Fibro-cartilage.* It is a pretty broad triangular lamina, of which the base is continuous with that of the tragus (1920), and with the anterior and inferior part of the concha. Irregularly curved from below upwards and from before backwards, it does not describe an entire circle, and forms a portion of canal completed by a fibrous membrane, and which is less long in the adult than the bony portion. Its inner extremity is prolonged inferiorly into a point and is only connected with the temporal bone by a fibrous tissue.

Near the tragus, this fibro-cartilage presents a transverse fissure. A similar one is observed a little farther on; and sometimes, although rarely, there even exists a third. These fissures, which are named the *incisuræ* of *Santorini*, occupy only a portion of the extent of the fibro-cartilaginous lamina, and are filled with a fibrous cellular tissue. Sometimes also they present muscular fibres; but these cannot be considered as forming a separate muscle, as some anatomists maintain.

1929. Of the *Fibrous Portion.* It unites above and behind the two edges of the fibro-cartilage, and completes the canal in this place. Sometimes it is very indistinct, but it is always prolonged between the fibro-cartilage and the circumference of the bony canal of the ear, and connects them with each other.

1930. *Of the Skin of the meatus auditorius.* It is a prolongation of that which invests the auricle. Presenting at first the same tint and thickness as the latter, it loses its whiteness and becomes thinner in proportion as it approaches the membrana tympani, over which it is reflected so as to form a kind of cul-de-sac. It is covered in its whole extent by a very fine down, and at its origin is furnished with pretty long and very apparent hairs. It presents a great quantity of porosities, which are the excretory orifices of the ceruminous glands. It adheres very feebly to the adjacent parts, and is connected with them by cellular tissue. Its adhesion, however, is more marked in the place where it invests the bony portion, and especially beneath; but it may be detached without effort from the membrana tympani.

1931. *Of the Ceruminous Glands.* They are met with under the skin, in the cellular tissue, at the upper and back parts of the canal, in the place where the fibro-cartilage does not exist. They have a spherical or elliptical form, a reddish-yellow colour, and a considerable density. Each of them has an excretory orifice of its own which opens into the meatus and pours out the cerumen there. Their intimate structure is very little known.

1932. The *Cerumen* is a thick, oily, very bitter fluid, of a yellow colour, partly soluble in water under the form of an emulsion, little affected by exposure to air, not putrescible, and incapable of being acted upon by alcohol. This humour is inflammable.—When placed upon a piece of lighted charcoal, it quickly intumesces and exhales a dense smoke of an ammoniacal and slightly aromatic smell. The charcoal which forms the residuum is in too small quantity to be analyzed. M. Vauquelin thinks that three substances form the base of the cerumen: a fat oil, an albuminous animal mucilage, and a colouring matter.

1933. The *arteries* of the external ear are furnished by the posterior auricular, temporal, and stylo-mastoid branches. Its *veins* exactly correspond to the arteries. The *lymphatics* go to the ganglia situated behind the ramus of the jaw, and upon the outer surface of the sterno-cleido-mastoideus muscle. Its *nerves* are furnished by the superficial temporal (1600), and posterior auricular (1608) nerves, the temporal twigs of the facial (1613), and the mastoid (1673), and auricular (1674) twigs of the cervical plexus.

B. *OF THE MIDDLE EAR OR TYMPANUM.**

1. OF THE CAVITY OF THE TYMPANUM, HAVING ITS SOFT PARTS REMOVED.

1934. The *Tympanum* is a cavity of an irregular form, difficult to be described, situated in the base of the petrous portion of the temporal bone, between the meatus auditorius externus and the inner ear, properly so called, or labyrinth, above the glenoid fossa, before the mastoid process and its cells, and behind the Eustachian tube. Its breadth is but small; but it is liable to vary on account of the motions to which the membrana tympani is subject. It is always larger above than below. Its antero-posterior diameter is a little greater than the vertical diameter. A mucous membrane lines it over its whole extent, and it communicates with the external air by means of the Eustachian tube, placed between it and the pharynx. Six walls are distinguished in the tympanum.

1935. *Outer wall.* Directed somewhat obliquely from above downwards, from without inwards, and from behind forwards, it is formed almost entirely by the *membrana tympani*, a kind of septum which closes the lower extremity of the auditory canal, and which is very distinct from the mucous membrane of the cavity of the tympanum, and from the skin which lines the auditory canal (1930). The latter, in particular, may be detached from it with the greatest ease.

The membrana tympani, presenting the obliquity which we have just mentioned, forms, with the inferior wall of the auditory canal, a very acute retiring angle, while it seems almost a continuation of the superior. Its form is that of a circle. Its extent is a little larger than that of the aperture which it is destined to close, whence there results, that it is capable of experiencing very distinct alternate motions of relaxation and tension. For the same reason, it is commonly found convex in one or other direction, but more commonly internally, where it always presents, moreover, a partial elevation produced by the presence of the handle of the malleus. This elevation produces a corresponding depression on the side next the auditory canal.

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* *Τυμπανον*, *Tympanum*, a Drum.

The circumference of the membrana tympani is, as it were, cased in the groove with which the internal extremity of this canal is marked.

1936. The membrana tympani is thin, transparent, dry, fibrous, destitute of blood-vessels in the ordinary state. It is not perforated by any aperture, as some anatomists have alleged, and permits no direct communication between the tympanum and the meatus auditorius externus.

It promptly hardens under the action of heat, and is not putrescible.

1937. Above and below, the outer wall of the tympanum is formed by two small uneven osseous surfaces.

1938. *Internal Wall.* It is but slightly inclined backwards, and is more distant from the external wall above than below. The objects which are remarked in it are the following.

1. The *Fenestra Ovalis*, an aperture of an oval form, which forms a communication between the tympanum and the vestibule. Its greatest diameter is horizontal, the other vertical. Its upper edge is curved in the form of a half ellipse; the lower is nearly straight. On the side next the vestibule, it is contracted by a small very flat rim, which occupies its circumference.

The fenestra ovalis is closed by the base of the stapes, which not being altogether so large, is embraced by a delicate membrane, which unites it in a moveable manner to the circumference of the aperture.

Above the fenestra ovalis, there is remarked a bony eminence, rounded and elongated backwards and downwards. It indicates the course of the aqueduct of Fallopius at this point (183).

2. The *Promontorium.* This is another pretty broad tubercular eminence, of a variable form, which limits the fenestra ovalis below. This prominence is formed by the outer side of the vestibule, and by the corresponding scala of the cochlea. It is bounded behind by an irregular depression. Anteriorly, it corresponds to the extremity of a bony lamina, which separates the Eustachian tube from the inner muscle of the malleus.

3. The *Fenestra Rotunda.* Placed beneath and a little behind the promontory, this is of smaller dimensions than the fenestra ovalis, and forms a communication between the inner scala of the cochlea and the tympanum. It is situated at the bottom of a cavity, or kind of oblique, irregular funnel-shaped canal, which withdraws it in a great measure from the view on the side next the tympanum. It is not round, as its name would imply, but of a triangular form. It is closed by a particular membrane which is not parallel to that of the tympanum. In the first months of gestation it is directed almost anteriorly. Towards the period of birth, it is already turned obliquely backwards by the development of the tympanum. But afterwards, it inclines outwards, and a little downwards, from the effect of the formation of the mastoid cells, and of the growth of the process which contains them.

1939. *Superior Wall.* There is observed in it a certain number of porosities which give passage to small blood-vessels which form a communication between the dura mater and the mucous membrane of the tympanum. It has very little thickness, and presents nothing else remarkable.

1940. *Inferior Wall.* There is seen in it the glenoid fissure (173), through which issue the long process of the malleus and the corda tympani (1802), and by which there enter the anterior muscle of the malleus and some blood-vessels.

1941. *Posterior Wall.* In the upper part of this wall, there occurs a short scabrous canal, not lined with a layer of compact tissue, like the other bony canals, directed obliquely backwards and downwards, placed above the short branch of the incus, with a triangular free orifice, not closed by a membrane. This canal leads to the *Mastoid Cells*, formed in the interior of the mastoid process (175), developed in the direct ratio of the age, and varying in number and figure. Those of the circumference are in general of the same size as the cellules of the diplöe of the rest of the temporal bone; but, at the centre, there are three, four, or five much larger, and even sometimes confounded together so as to form a single cavity. They all communicate with each other; but are separated from the other cellules of the bone by a prolongation of the mucous membrane of the tympanum.

Beneath the aperture of the mastoid cells, behind the fenestra ovalis, and at the lower part of the prominence formed by the aqueduct of Fallopius (1938), is a small hollow conical eminence, more or less prominent. This is the *Pyramid* or *Eminentia pyramidalis.* Its summit is directed forwards, and gives passage to the tendon of the muscle of the stapes, the fleshy body of which is contained in a canal which occupies the centre of the eminence.

Under the base of the pyramid is a small aperture which communicates with the aqueduct of Fallopius, and through which the upper twig of the vidian nerve penetrates into the tympanum (1804).

Sometimes also the summit of the pyramid is connected with the promontory by one or two bony filaments.

1942. *Anterior Wall.* It presents a small, thin, projecting bony plate, curved upon itself from beneath upwards, and commonly named the *Processus cochleariformis.* This plate separates in its whole length two canals situated in the retiring angle of the tympanum, which receives the spine of the sphenoid bone (181), and placed one above the other. The superior canal is rounded, lined with a very delicate periosteum, and filled by the internal muscle of the malleus. It presents the aperture of an extremely narrow canal which ascends in the groove placed before the *hiatus Fallopii*, and which gives passage to a filament of the superficial petrous nerve, which goes to meet on the promontory another filament of the same nerve of which we shall presently speak. The inferior forms the bony portion of the Eustachian tube. Under the extremity of the processus cochleariformis there opens a narrow and pretty long canal, which obliquely traverses the substance of the bone, and, on the one hand, goes to gain the same groove of which we have just spoken, while, on the other, it degenerates itself into a groove which passes over the circumference of the fenestra ovalis, the promontory and the anterior edge of the fenestra rotunda in succession, to be finally converted into a canal which descends in the groove by which the carotid canal is separated from the sinus of the jugular vein, and terminates in a small fossa. This canal is traversed by a filament of the superficial petrous nerve, which ascends to anastomose on the promontory with a filament of the superior cervical ganglion, to go along with it, united into one, and accompanied by a small artery, to throw itself into the terminating fossa, and be confounded with the glosso-pharyngeal nerve, after throwing some filaments into the membrana tympani and into the membrane of the fenestra ovalis.

1943. *Of the Eustachian Tube.* This name is given to a canal partly osseous, partly fibro-cartilaginous and membranous, which extends from the cavity of the tympanum to the upper part of the pharynx. Inclined obliquely forwards, inwards and downwards, it is about two inches in length, and has consequently a greater extent than the auditory canal. Its bony portion, which is from eight to nine lines in length, and is situated above the carotid canal, internally of the glenoid fissure and of the spine of the sphenoid bone, commencing in the tympanum by a pretty wide orifice, is itself narrow and rounded in its middle part. Its fibro-cartilaginous portion increases progressively in diameter, and is compressed so as to present an elliptical section. It terminates near the inner wing of the pterygoid process, behind the posterior aperture of the corresponding nasal fossa, by a kind of wide, free, bulging pavilion, of which the edges are applied upon each other so as to form only a fissure of no great width. This last portion of the Eustachian tube, which is placed under the base of the skull, is surrounded by the peristaphyline muscles and by cellular tissue. At its internal orifice, it is embraced by the mucous membrane of the pharynx.

1944. The *Fibro-cartilage* of this canal, placed internally, flattened in the greater part of its extent, irregularly quadrilateral, curved upon itself from beneath upwards and from within outwards, forms at first its whole inner wall, and afterwards constitutes the upper region of the outer wall. It seems to result from the angular junction of two distinct laminæ, of which the outer is very narrow, and even pretty frequently does not exist at all.

Differing in this respect from the fibro-cartilage of the auditory canal, the cartilage of the Eustachian tube is not only connected with the bony portion by a kind of ligament, but is dove-tailed as it were into its inequalities. Near the foramen lacerum anterius, it is identified with the fibro-cartilaginous lamina which closes it, and adheres to the middle of the inner wing of the pterygoid process, as well as to the spine of the sphenoid bone, by a dense and fibrous substance. Externally, it affords points of attachment to the pterygoideus internus and circumflexus palati (1007). Its lower edge gives attachment behind to the levator palati mollis, which runs along it the rest of its extent (1006), and to the inner muscle of the malleus (1955).

1945. The *membranous portion* of the Eustachian tube nearly forms of itself the outer half of that canal. It unites together the two edges of the fibro-cartilage, and is essentially formed by a prolongation of the mucous membrane of the pharynx, which lines the whole internal surface of the tube. It is merely strengthened externally by bundles of fibres which come from the spine of the sphenoid bone, and from the base of the pterygoid process. This fibrous layer then gives attachment to some portions of the circumflexus palati mollis, and stops short at the level of the bony portion, where the mucous membrane alone introduces itself, and is applied upon a very thin layer of periosteum. This mucous lamina is white, and is much thinner than the membrane of the pharynx, of which it appears to be an appendage. Towards the pharyngeal orifice of the canal, it forms a very thick prominent rim, and contains a great number of mucous crypts.

1946. The Eustachian tube is constantly open. Its nerves are furnished by the palatine twigs of the ganglion of Meckel (1741). Its vessels come from those of the velum palati and pharynx.

2. OF THE BONES CONTAINED IN THE CAVITY OF THE TYMPANUM.

1947. The cavity of the tympanum is traversed by a series of small bones, articulated with each other by diarthrosis, moved by muscles of their own, and extended from the membrana tympani to the fenestra ovalis, representing a kind of bent lever. They are named the malleus, incus, os lenticulare, and stapes.

1948. *Of the Malleus.* It is placed nearly vertically on the inner and upper part of the membrana tympani. It is the longest of the internal bones of the ear, and is divided into three parts, which are named the *head*, the *neck*, and the *handle*. The *head* forms its highest and largest part. Smooth over its whole extent, of an oval form, somewhat elongated, it corresponds externally to the squamous portion of the temporal bone, and is a little concave before. It is articulated posteriorly to the incus by means of two slight depressions separated by a prominence, and covered by a very thin cartilage. The *neck* is a kind of contraction placed between the head and the handle. It is very short, but pretty thick. Inclined outwards, it is free posteriorly and internally. Anteriorly, it supports a very elongated slender process, which traverses the glenoid fissure and gives attachment by its summit to the anterior muscle of the malleus. It is named the *process of Raw*. The

Handle, which is much narrower than the neck, forms with it an obtuse angle, retiring inwards. Its inferior extremity, which is thin and rounded, is inclined forwards, and corresponds to the centre of the membrana tympani. From the superior there issues externally a short and narrow process, which directs itself a little backwards and gives attachment to the internal muscle of the malleus. In its whole extent the handle is slightly compressed from before backwards, and forms one of the radii of the membrana tympani, against which it is fixed by the mucous membrane of the cavity, which covers it internally.

1949. *Of the Incus.* Situated beside the malleus, and externally of it, the incus corresponds to the posterior and external parts of the cavity of the tympanum, towards the orifice of the mastoid cells (1941). A little thicker, but shorter than the malleus, it bears a considerable resemblance to a molar, tooth with two widely separated roots. There are distinguished in it a body and two branches. The *Body* forms its anterior part. It is directed a little upwards, and represents a transversely flattened ovoid, having its greatest diameter vertical. Its inner surface is a little concave, and the outer convex. The anterior, for its articulation with the malleus, presents two unequal tubercles, of which the upper is the larger, separated by an intermediate depression, and encrusted with a thin cartilage. The *Superior Branch* is horizontal, shorter, thick, conical and flattened. Its summit corresponds to the entrance of the mastoid cells. The *Inferior Branch*, which is longer, more slender, descending vertically, rounded, nearly parallel to the handle of the malleus, and about half a line distant from the membrana tympani, presents at its summit, which is bent inwards, a slight cavity which is articulated with the os lenticulare.

1950. *Of the Os Lenticulare or Os Orbiculare.* Much smaller than the other three, rounded, and slightly convex on its two surfaces, it is interposed between the long branch of the incus and the head of the stapes, and is articulated with these two parts.

1951. *Of the Stapes.* It presents exactly the form of a stirrup, and is placed horizontally between the os lenticulare and the fenestra ovalis. There are distinguished in it a head, two branches, and a base. The *Head*, which is very small, and situated externally, is supported by a very short neck, which results from the union of the two branches, and gives attachment to a small muscle. Its summit presents a depression for its articulation with the os lenticulare. Of the two *Branches*, the one is anterior and the other posterior. They separate from the neck in a divergent manner, and circumscribe between them a parabolic space. The first is less curved and shorter than the second. Both present on their opposite sides a groove, which is continued over the outer surface of the base, and in which is attached a very delicate membrane, which fills up their interval. The *Base*, which forms the innermost part of this bone, is a very thin and pretty broad plate, elongated from before backwards, continuous with the two branches at its extremities, convex internally and concave externally. It presents a form corresponding to that of the fenestra ovalis (1938), which it closes inaccurately, and to the circumference of which it is united by the mucous membrane of the tympanum.

1952. The bones of the ear are almost entirely composed of compact tissue. The malleus, incus, and stapes alone present a little cellular tissue in their thick portions. Each of them appears to be developed by a single centre of ossification, and they are remarkable for the size and compactness which they already possess in the fetus. Their articulations are destitute of ligaments, and they appear to be connected with each other only by means of the mucous membrane which lines the cavity of the tympanum. It is not known whether they have a periosteum, the existence of which it would be difficult to ascertain.

3. OF THE MUSCLES OF THE BONES OF THE EAR.

1953. Of the *Tensor Tympani* or *Internal Muscle of the Malleus.* It arises in part from the rough surface which the petrous process presents before the inferior orifice of the carotid canal, and in part from the fibro-cartilage of the Eustachian tube. At first aponeurotic, it soon becomes fleshy, directs itself backwards and outwards, and enters into a particular canal of the temporal bone (1942), separated from the Eustachian tube by the processus cochleariformis, and surrounded by a very strong membrane. On arriving at the tympanum, it degenerates into a small tendon, which is reflected over the extremity of the processus cochleariformis, and is inserted into the process of the handle of the malleus. Its use appears to be to stretch the membrana tympani, by drawing the malleus inwards. It receives a filament from the facial nerve (1605).

1954. *Of the Laxator Tympani,* or *Anterior Muscle of the Malleus.* Much more slender than the preceding, it arises from the spine of the sphenoid bone and from the outer part of the fibro-cartilage of the Eustachian tube, by very short aponeurotic fibres. It ascends outwards and backwards, enters the glenoid fissure, and is inserted, by a tendon, into the summit of the process of Raw, (1948). It probably relaxes the membrana tympani, by drawing the malleus outwards and forwards.

1955. *Of the Stapedius* or *Muscle of the Stapes.* Still smaller than the preceding, it arises from the bottom of the cavity of the pyramid, which contains the whole of its fleshy portion in its interior. It presently changes into a very short tendon which issues by the summit of that eminence, directs itself forwards, and after a course of one line, attaches itself to the posterior part of the neck of the stapes. It appears to impress a see-saw motion on this bone, n consequence of which the posterior extremity of the base is sunk in the vestibule, while the anterior is raised in the cavity of the tympanum.

4. OF THE MUCOUS MEMBRANE OF THE TYMPANUM.

1956. This is what most authors designate by the name of *periosteum.* It evidently comes from the mucous membrane of the pharynx along the Eustachian tube, which it lines in its whole extent, (1933). On arriving in the tympanum, it lines all its walls, extending over their eminences and diving into their depressions. It contributes to close the fenestra ovalis and fenestra rotunda, is applied against the membrana tympani, from which it is separated by the handle of the malleus; embraces the pyramid, and loses itself around the tendon of the stapedius, giving also in this place a very delicate envelope to the corda tympani (1802); enters the mastoid cells, and separates them from the diploe of the temporal bone, lining them closely; appears to be reflected over the processus cochleariformis to embrace the tendon of the tensor tympani muscle; closes the glenoid fissure, and surrounds the process of Raw; and lastly, is deflected over the bones of the ear, which it fixes to each other.

1957. This membrane, which is extremely thin, appears somewhat fibrous externally. It is perhaps united to a lamina of the periosteum; but internally, it is assuredly mucous. In the adult, and in old age, it is white, dull, firm, with little appearance of vascularity, and bears a great resemblance to the mucous membrane which invests the sinuses of the nasal fossæ. In children, it has a reddish tint, and is traversed by a great number of blood-vessels. It constantly exhales a mucous fluid, which flows into the pharynx by the Eustachian tube; but neither crypts nor villosities are observed in it.

1958. The arteries of the middle ear are furnished by the stylo-mastoid, middle meningeal and internal carotid arteries. Its veins are very difficult to be traced. The nerves that are met with belong to the spheno-palatine ganglion.

6. OF THE INTERNAL EAR OR LABYRINTH.

1959. This portion of the organ of hearing, which is situate between the tympanum and the meatus auditorius internus (177) is composed of several cavities which communicate together in th dry bone, and which are designated by the names of vestibule, cochlea and semi-circular canals.

1. OF THE VESTIBULE.

1960. The *Vestibule* is a cavity of an irregular form, approach ing however somewhat to that of a spheroid. It is situated internally of the tympanum, in which it forms a prominence which contributes to the formation of the promontory (1938,2°), externally of the meatus auditorius internus, anteriorly of the semicircular canals, and posteriorly of the cochlea. Above and below it is covered by the compact tissue of the petrous process. It is divided into two unequal portions of different forms, by a bony crest which rises from its inner wall, directs itself outwards and a little forwards, and terminates above the fenestra ovalis by a very small pyramid with a flattened and wrinkled summit.

In the vestibule the following apertures are observed: 1*st*, externally, the inner orifice of the fenestra ovalis, closed by the base of the stapes, and shut moreover on this side by the proper membrane of the vestibule; 2*dly*, above, the two anterior orifices of the superior vertical and horizontal semicircular canals; 3*dly*, anteriorly and inferiorly, the orifice of the external scala of the cochlea; 4*thly*, posteriorly, the two separated apertures of the posterior vertical and horizontal semicircular canals, and an aperture common to the two vertical canals, the latter preceded by a groove, while the other orifices are formed in a mere depression; 5*thly*, internally, several holes which give passage to blood-vessels and filaments of the acoustic nerve (1622), and which communicate in the internal auditory canal.

1961. *Of the Aqueduct of the Vestibule.* This name is given to an extremely narrow canal, which forms a communication between this cavity and the base of the skull. It commences in the vestibule by an orifice which is frequently almost imperceptible, internally of and very near the common orifice of the two vertical semicircular canals. From thence it directs itself at first upwards, then backwards and downwards, and opens, becoming wider, on the posterior surface of the petrous process (177), in a small cavity of the dura mater.

2. OF THE COCHLEA.

1962. This is a bony cavity, formed of two conical canals, spirally twisted like a univalve shell, from which circumstance it has obtained its name. It is formed in the anterior part of the petrous process, anteriorly and internally of the vestibule and internal auditory canal. Inclined from within outwards, from above downwards, and from behind forwards, it describes two spirals running in inverse directions, according as they are examined in a left or in a right temporal bone. There are distinguished in the cochlea an axis or central nucleus, a lamina which forms its walls, and which is named the *lamina of the circumference*, a spiral septum, and an aqueduct.

1963. The *Axis*, *Nucleus*, or *Modiolus*, commences towards the bottom of the internal auditory canal, and is directed nearly horizontally forwards and outwards, towards the inner part of the carotid canal. It is conical. Its base, which is pretty broad, is marked with a depression which is observed at the bottom of the internal auditory canal. This depression lodges the cochlear branch of the acoustic nerve (1621), and transmits it into the interior of the cavity by a great number of porosities. It terminates, becoming narrower, towards the summit of the axis itself, which is marked with a small cavity named the *Infundibulum*, and of which the entrance is wide and slanting. The surface of the bony axis is spirally marked by a double groove, and presents a great number of small holes for the passage of the nervous filaments of which we have just made mention.

1964. The *Lamina of the circumference of the Cochlea*, immersed in the spongy tissue of the petrous process, of the form of a very elongated isosceles triangle, were it supposed to be developed and extended, is compact and bent upon itself in the direction of its breadth. It forms a kind of half canal, of which the edges are a little thicker than the rest and firmly united to the axis, around which it describes two spiral turns and a half, advancing upon the infundibulum. These turns are closely united together in the place where they meet, and form an equally spiral cavity which goes on gradually diminishing.

1965. The *Lamina Spiralis*, or *Spiral Septum of the Cochlea*, divides this cavity in its whole length into two parts. Bony in the portion connected with the axis, it is membranous in that connected with the lamina of the circumference. Broader towards the base of the cochlea, it ends upon the axis, towards the middle of the second turn, by a kind of hook where the point of the infundibulum commences. In its bony portion it is composed of two lamellæ between which there is observed a great number of small canals for nerves. Its membranous portion is extremely thin, and exists alone from the middle of the second turns to the summit, where it is perforated by a small rounded aperture.

1966. The two cavities which result from the presence of this septum have been called the *Scalæ* or *Gyri*. One of them is internal, the other external. The former would communicate with the cavity of the tympanum by the fenestra rotunda were it not closed by its membrane. The latter opens freely into the vestibule. The internal is broader and shorter, and the surface of the septum which corresponds to it is wrinkled and uneven. The external is narrower and longer, and the surface of the septum which corresponds to it presents prominent radiating lines. They communicate with each other by the aperture of the summit of the septum, and gradually contract from their commencement to their point of communication. The vertical section of each of them presents nearly the form of a semicircle.

1967. The *Aqueduct* is an extremely narrow canal, of which the upper orifice is seen in the internal scala, near the fenestra rotunda, and the inferior on the posterior edge of the petrous process (189), before the jugular fossa. It is from three to four lines in length, descends obliquely forwards, and represents a very longated hollow cone. Frequently it is very small, and even seems to be wanting altogether.

3. OF THE SEMI-CIRCULAR CANALS.

1968. These canals, whose form is indicated by their name, are formed in the substance of the petrous process, and open by their two extremities in the interior of the vestibule, behind which they are situated, corresponding posteriorly and inferiorly to the mastoid cells. They are three in number, and their direction is different, two being vertical, the one superior, the other posterior, and the third horizontal. They leave between them a pyramidal space the base of which is directed outwards and the summit inwards and backwards. This space is filled by the diploe of the petrous process. In the fœtus, it remains empty, and is occupied by a prolongation of the dura mater.

1969. The *Superior Vertical Canal*, which is a little smaller than the posterior, but larger than the horizontal, presents the convexity of its curvature directly upwards. One of its sides is anterior, the other posterior, and of its extremities the one is external the other internal. It commences at the upper and fore part of the vestibule, by a pretty large and elliptical aperture, close to one of those of the horizontal canal. It terminates by uniting posteriorly and internally with the posterior vertical canal, and forms with it a common canal, about two lines in length, which opens at the upper and inner part of the vestibule by a single rounded orifice. This common canal has not a greater capacity than either of the two from which it results.

1970. The *Posterior Vertical Canal* presents its convexity backwards, one of its extremities being directed forwards and upwards, the other forwards and downwards. The first is united, as we have said, with the preceding canal. The other opens separately in the lower and inner part of the vestibule, a little above one of the apertures of the horizontal canal, by a wide, rounded, or elliptical orifice.

1971. The *Horizontal Canal* is the smallest of the three. Situated between the other two, it commences anteriorly by a pretty wide infundibuliform aperture, between that of the superior vertical canal and the fenestra ovalis, and terminates internally of the vestibule by a narrow aperture, between the common orifice of the two vertical canals and the lower orifice of the posterior. Its convexity is turned backwards.

1972. The three semicircular canals open therefore in the vestibule by five orifices only, and these orifices are unequal for each canal in particular. Their walls are formed of a compact lamina, immersed in the spongy tissue of the petrous process. Their internal surface is smooth and polished.

4. OF THE SOFT PARTS OF THE INTERNAL EAR.

1973. All the cavities of the internal ear are lined by a very fine and very delicate membrane. There is observed, moreover, in each semicircular canal, a membranous tube of a diameter much smaller than the bony canal, and attached to the latter by a very fine cellular tissue. The isolated orifices of the vertical canals and the anterior orifice of the horizontal canal, are furnished each with an ampulla or membranous enlargement which sometimes disguises them. These three ampullæ, as well as the opposite extremities of those canals which are destitute of them, end in a common sac which occupies a portion of the vestibule. These parts are filled with a humour which gives to the common sac the appearance of an air-bubble, and to the membranous tubes that of lymphatic vessels, and the whole besides floats in the water of the labyrinth.

Another small sac contiguous to the preceding, but not communicating with it, immediately lines the vestibule, and adheres strongly to its walls. It is filled with a humour of its own, and is composed of thick and strong coats, in which the vestibular ramifications of the acoustic nerve lose themselves. It sends a prolongation into the aqueduct of the tympanum, and this prolongation terminates by a small cul-de-sac under the dura mater. In the substance of this membranous sac, there sometimes occur small canals which are filled with mercury by pressure, when the cavities of the labyrinth are filled with that fluid. They communicate with each other, and open partly into the veins of the dura mater, or form a small sinus of their own, which throws itself into the lateral sinus of that membrane.

The membrane of the vestibule introduces itself into the cochlea by the orifice of the external scala. It passes along the latter in its whole extent, and descends again into the internal scala by the aperture of the summit of the spiral lamina, to the fenestra rotunda, near which it sends a prolongation into the aqueduct of the cochlea. This prolongation also terminates by a cul-de-sac under the dura mater.

1974. The nature of this membrane is unknown; it is vascular in the child; but in the adult it becomes much less so, and is so thin, and adheres so strongly to the bone that it can scarcely be perceived. It exhales a transparent, slightly viscid fluid, which fills all the cavities of the internal ear, and which is more or less abundant.

1975. The arteries of the internal ear come from the meningeal, stylo-mastoid, internal carotid and basilar arteries. The vestibule has a vein which throws itself into the sinus of the internal jugular vein, after traversing the substance of the petrous process by a small canal whose orifice is near that of the aqueduct. Some of these roots come from the semi-circular canals. The cochlea has another vein which issues from the internal scala near the aqueduct, traverses the petrous bone, and opens into the lateral sinus. We have described the acoustic nerve (1620), which is chiefly and solely destined for the internal ear.

ARTICLE THIRD.

OF THE NOSE AND NASAL FOSSÆ, OR ORGANS OF SMELL.

A.—OF THE NOSE IN GENERAL.

1976. The *Nose (Nasus)* * is a pyramidal eminence, which varies much in its form and dimensions. It is placed above the anterior aperture of the nasal fossæ (325), which it covers and protects. It therefore occupies the middle and upper part of the face, between the forehead and upper lip, the orbits and the cheeks.

Its lateral surfaces are separated from the cheeks by a semicircular groove, and form, by their union, a kind of rounded line, more or less straight, and of variable length, which is named the *back of the nose*. This line is terminated by a prominent portion, which is named the *lobe*, and beneath which are two apertures separated by a partition which is continuous with that of the nasal fossæ. Their form is oval, and they are always open. Their outer sides constitute the *wings of the nose*, and their partition loses itself in the upper lips, forming a small groove in its middle part. They are named *nostrils*.

1977. The more common direction of the nose is that of the median line of the body. It is not at all rare to see individuals, however, in whom it is more or less inclined to either side, whether this kind of deformity depends upon the bones, or only upon the soft parts.

1978. The form of this organ does not vary less than its direction, and these variations depend upon its general figure or upon that of some of its parts only.

The variations which act upon the general conformation of the nose may be referred to three principal kinds, viz.: 1st, the *aquiline nose*, elongated, a little pointed and inclined downwards; 2dly, the *flat nose*, which is very thick, and has its apertures directed more or less forwards; 3dly, the *turned-up nose*, in which the lobe is raised and more or less pointed.

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* Ριν of the Greeks.

But besides these variations in the general form, others occu in each individual part. Thus the nostrils are sometimes a mer slit, and in other cases much dilated. They may also be horizontal, or more or less oblique. The back of the nose is rectilinea in some persons, while in others it is gibbous, curved, hollow, &c.

B. ORGANIZATION OF THE NOSE.

1979. Besides the bones which we have already seen entering into the composition of this organ, and which we have describe (270), there contribute to its formation a dermal layer, membranous fibro-cartilages, a cartilage properly so called, muscles, vessel and nerves; and all these parts are so disposed, that its upper region, which is more solid than the rest, more efficaciously protect the special organ of smell (1538), while the lower, which is les firm, but mobile, allows the apertures of the nostrils to be contracted, widened, or even closed, according to circumstances.

1980. *Of the Dermal Layer of the Nose.* Like that of the rest of the face, it is fine and smooth. No hairs are observed upon it. Its reticular tissue is especially very apparent. It is but loosely attached to the subjacent parts above; but below, and on the sides of the wings, it adheres very firmly to them.

There is very little cellular tissue under the integuments of the nose. At the upper part of the organ, this tissue contains adipose vesicles; but inferiorly it seems formed by a fibrous lamina which ascends towards the moveable aponeurosis of the pyramidalis and triangularis nasi muscles (496).

1981. The skin of the nose furnishes a kind of mild and mucous oil, which diffuses itself in the groove by which it is separated from the cheek. This humour is produced by a multitude of small yellowish utricular follicles, which exist in the substance of the integuments, and especially in the groove of the wings o the nose. The sebaceous fluid which they contain may be squeezed out in the form of small worms, whether during life or after death. Their form is in general that of a small oval sac, whose aperture is slightly contracted. They seemed lined in their interior by a kind of mucous membrane, and their orifice is furnished with four or five excessively minute hairs, and sometime has a decided black tint. Their number is considerable, and thei volume less than that of the ceruminous glands.

1982. For the *Muscles of the Nose*, see p. 279.

1983. *Of the Cartilage of the Nose.* It occupies the middle region of the organ, and is formed of three portions united at an acute angle, and distinguished by most anatomists into the *Latera Cartilages*, placed anteriorly and externally, and the *Cartilage o the Septum*, situated posteriorly and anteriorly.

The *Cartilage of the Septum*, which forms the largest portion, is prolonged into the nasal fossæ. It is of a triangular form, and although generally situated in the median line of the body, in a vertical direction, may be inclined more or less perceptibly to either side, so that its two lateral surfaces, instead of being plain, are then convex on the one side and concave on the other. These two surfaces are invested by the pituitary membrane. They present a great number of small porosities, which make them appear as if shagreened, and which receive prolongations of that membrane. Sometimes also this cartilage is perforated by a hole which allows the nasal fossæ to communicate with each other.

Its upper edge is uneven, very much inclined backwards and downwards, and articulated with the lower edge of the vertical plate of the ethmoid bone, which sometimes divides into two laminæ for its reception. The lower edge presents two portions, a posterior and an anterior. The former is longer, inclined a little downwards and forwards, and is received into a groove of the vomer. The latter, which is shorter, rounded, free, and without any attachment to the neighbouring parts, is placed between the internal branches of the fibro-cartilages of the nasal apertures, to which it is only attached by a loose cellular tissue, and along with which it contributes to form the septum of the nose. Its anterior edge is subcutaneous, prominent and very thick above, becomes thin below, and is entirely concealed by the fibro-cartilages of the nasal apertures, between which it unites, at an obtuse angle, with the inferior edge.

It is from the upper half of this anterior edge that the two lateral portions arise, which are at first continuous with it, but which, farther down, are separated from it by a fissure filled with cellular substance. They direct themselves obliquely over the sides of the nose, under the ossa nasi. Their form is triangular. They are attached above and below to the nasal bones and the ascending processes of the superior maxillary bones. A much less compact tissue, which sometimes is only a mere membrane in which are developed some amorphous fibro-cartilaginous nuclei, unites them below to the fibro-cartilages of the nasal apertures. Externally, they are covered by the triangularis muscle, and lined internally by the pituitary membrane. They are somewhat less capable of being ruptured, and appear more flexible than the first portion.

The three portions of this cartilage seem to be sometimes separated and distinct, there being observed on the anterior edge of the septum, along the union of the lateral portions, a superficial groove which terminates by a very small ridge.

1984. *Of the Fibro-cartilages of the apertures of the Nose.* It is very difficult to determine their size and form. In general, however, they represent an ellipse truncated posteriorly. They are curved upon themselves, presenting the appearance of two branches, an inner and an outer, meeting at an angle. By their union, they constitute, anteriorly, and on each side, a more or less distinct prominence, separated by a groove from that of the opposite side. The outer, which is directed a little upwards and backwards, terminates in the latter direction by an extremity rounded at the point, which loses itself in the membranous tissue by which it is connected with the lateral portions of the preceding cartilage. It is covered externally by the triangularis muscle and the integuments; internally, by the pituitary membrane.

The internal branch, which is contiguous to the septum, forms anteriorly part of the inferior extremity of that part. It is horizontal and sometimes situated a little lower than the first. Lined externally by the mucous membrane, and contiguous internally and posteriorly with the cartilage of the septum, it approaches that of the opposite side internally and anteriorly, and is connected with it by a loose cellular tissue never containing fat. Rather broad before, this internal branch terminates posteriorly in a point. It is its contiguity with that of the opposite side that gives the septum of the nose the thickness which it presents inferiorly.

1985. *Of the Fibro-cartilages of the Wings of the Nose.* In some subjects they are continuous with the external branch of the preceding. Their disposition is very irregular, and their form very liable to vary. Placed in the posterior parts of the wings, near their union with the cheeks, they are of inconsiderable size, and are often divided into several distinct and isolated nuclei. They seem immersed in a kind of fibrous membrane which fixes them to the preceding fibro-cartilages, the lateral cartilages of the nose, and the concave rim of the maxillary bone.

1986. These four fibro-cartilages are thin, and allow a certain degree of mobility to the lower part of the nose. They are enveloped by a very evident, thick, fibrous tissue, which adheres intimately to them. Their elasticity is great.

C. OF THE NASAL FOSSÆ INVESTED BY THEIR MEMBRANES.

1987. When these cavities are examined in a head of which the soft parts have not been removed, their form is found very different from that which we have described at page 100. All those inequalities, grooves, and small eminences which we have pointed out, are no longer seen. The meatus, under the form of three longitudinal channels, limited by the three turbinated bones, are on the outer wall the only parts that can be recognised. Still the inferior edge of the turbinated bones descends much lower than in the dry head, because a membrane which invests them, as well as all the other parts of the nasal cavities, forms in passing over it a thick and very distinct fold. This membrane has received the names of *Pituitary Membrane*, *Olfactory Membrane*, and *Schneiderian Membrane.*

D. OF THE COURSE OF THE PITUITARY MEMBRANE.

1988. This membrane, which belongs to the class of mucous membranes, lines in their whole extent the nasal fossæ and internal part of the nose, from the apertures of the nostrils to the pharynx, where it is continuous with that of the mouth, the velum palati and Eustachian tube, while anteriorly it seems to arise from the skin. It is prolonged over all the eminences of the olfactory cavities. It penetrates into all their anfractuosities and has an extremely complicated course.

After covering the floor of the nasal fossæ, it ascends in the inferior meatus and covers it. There it meets the orifice of the nasal canal (350), dives into it, and is thus continuous with the tunica conjunctiva of the eye through the puncta lachrymalia. In this place it forms a small circular and very distinct replication, which much contracts the entrance of the duct, but whose disposition is very variable. Sometimes this replication contracts the orifice of the duct to such a degree that a stylet cannot be introduced into it without difficulty.

From the inferior meatus, the pituitary membrane is reflected over the inferior turbinated bone, to which it adheres only in a rather loose manner. Below the turbinated bone, it forms, especially behind, a replication which descends lower than it, and which consequently enlarges it. This replication loses itself insensibly behind in the rest of the membrane.

Above the inferior turbinated bone, the membrane penetrates into the middle meatus, in the fore and upper part of which it finds an aperture (the *infundibulum)* more or less widened at the mouth, which allows it first to enter into the interior ethmoid cells, and afterwards into the frontal sinuses, without forming any kind of replication. A little more posteriorly is another aperture, frequently very narrow, leading into the maxillary sinus, which the membrane completely invests, forming around its bony orifice a very distinct fold, which contains between its two laminæ a glandular organ, respecting the existence of which we shall afterwards speak. There is also in a head which retains its soft parts, on account of the presence of this fold, a narrow membranous canal, inclined from before backwards, which leads into the sinus. Its entrance is placed before the aperture which the bones present (348), and is commonly concealed by a small bony lamina equally invested by the olfactory membrane.

Issuing from the middle meatus, the pituitary membrane extends over the convex surface of the ethmoidal turbinated bone, and forms on its free edge a rather loose fold, which terminates posteriorly in a point, but which does not sensibly increase the vertical extent of this bony plate.

On arriving in the meatus superior, it dives into the posterior ethmoid cells, which it covers like the anterior; passes over the spheno-palatine foramen, which transmits to it a certain quantity of nerves and vessels, and which allows a lamina of the periosteum of the pterygo-maxillary fissure to join it.

It then directs itself to the vault of the nasal fossæ, where it lines the cribriform plate of the ethmoid bone, of which it closes all the holes, so that the olfactory nerves terminate there at its external surface. Posteriorly, it covers the body of the sphenoid bone and sinks into the sphenoid sinuses, forming at their orifice a fold which contracts them more or less, according to the subject. Anteriorly, it is reflected over the posterior surface of the nasal bones, passes over the two or three foramina observed upon them, receiving the vessels to which they give passage. It descends from thence to the aperture of the nostrils, where it is furnished with a considerable number of hairs, and where it is distinguished by very remarkable peculiarities of organization.

Finally leaving the vault of the nasal fossæ, the pituitary membrane descends over the septum which separates them, without forming any replication, and thus arrives at the place from which we supposed it to set out.

E. OF THE ORGANIZATION OF THE PITUITARY MEMBRANE.

1989. Similar to the other mucous membranes with respect to the fluid which it furnishes, the pituitary membrane is continuous with several of them, that is to say, with those of the organs of digestion and respiration, and with the tunica conjunctiva of the eye. It also lines, like them, the interor of a cavity which communicates with the skin by apertures which that envelope presents at the surface of the body. But it differs from the other organs of the same kind in being thicker and softer, and truly deserves the epithet villous.

1990. The colour of the pituitary membrane varies in the different points of its extent, where it appears sometimes white and sometimes red. The latter tint predominates so long as it is not introduced into the sinuses, and is much more intense than in the other mucous membranes, even than in those of the stomach and small intestines. This red colour of the pituitary membrane depends upon the blood, which is in a state of circulation in it, and not upon the combination of that fluid with its tissue

1991. With respect to its more general disposition, this membrane cannot be considered as a mere mucous membrane, being evidently formed of two distinct laminæ, one of which is mucous, while the other, which is fibrous, is nothing else than the periosteum or perichondrium of the nasal cavities. The union of these two laminæ is of the most intimate nature, but their existence may be very easily recognised on the turbinated bones, and especially on the septum. On breaking the latter, and removing it by fragments, it is detached from the fibrous portion, which adheres much more to the mucous membrane than the bone, a disposition the reverse of the other portions of the periosteum, which are very strongly attached to the bones, and very little to the neighbouring parts.

When the membrane has been thus removed, its great thickness is easily seen, and it appears white, solid, dense, and strong on the side next the bones, spongy and red on the other.

The mucous lamina to which the latter qualities belong, is especially formed by a very distinct chorion, which approaches in thickness to that of the gums and palate.

1992. On drying, the pituitary membrane becomes transparent and very thin, and is closely attached to the surface of the nasal fossæ. If it be then moistened, it resumes in part its usual appearance. Under the influence of humidity it readily putrefies. It then assumes a grayish tint, and presently after the mucous portion may be removed from above the fibrous, under the form of a pap, in which all traces of organization have disappeared. Sulphuric acid and chlorin give it a blackish tint. Caustic potash dissolves it, or rather converts it into a soapy matter, with great readiness. By ebullition, it becomes thick, transparent, and gelatinous; separates from the bones in shreds: crisps and is rolled upon itself, acquiring a considerable degree of elasticity.

It swells much under maceration; but if, before submitting it to this operation, its vessels be injected, and the fluid in which it is steeped frequently removed, the surface of this membrane becomes downy, and is covered with very large and distinct villosities, the nature of which cannot be accurately determined. They are extremely close in the nasal fossæ, but in the different sinuses are scarcely distinguishable. Bichat supposes their base to be nervous.

1993. In most of the other mucous membranes, there exist glands situated under the chorion or even in its substance, and which continually pour forth, by small apertures, a mucilaginous humour, which lubricates their free surface. This disposition is not very apparent in the pituitary membrane, but it nevertheless exists n it. The fibrous layer being removed, there are sometimes perceived in its tissue granulations, which are somewhat difficult to be distinguished, on account of their being very close together, and which seem to form a true follicular layer, similar to that met with n the velum palati and arch of the palate, but less developed than n these places. In other circumstances, they are true crypts, of a pulpy consistence, thick, round or oval, and opening by a pore nto the nasal fossæ. They are then observed on the two sides of he septum, on the middle and inferior turbinated bones, and in he inferior meatus, especially near the pharynx. Their apertures are always pretty distinct in these different places. At the fore part of the septum there is even seen a large transverse lacuna, common to a great number of these follicles, which form a layer of he breadth of the little finger, of a reddish colour, and parallel to the floor of the nasal fossæ. Some others, but less developed, are also observed behind the septum. This structure is rendered very apparent by slight maceration in water.

Moreover, the duplication of this membrane which closes the entrance of the maxillary sinus, contains a true gland, of an irregular form, and covered with an innumerable quantity of small excretory vessels. In man, this organ is much less developed than in animals, in which it pours out a particular fluid by means of a very long and voluminous canal.

1994. The pituitary membrane does not present a uniform structure in its whole extent. Near the nostrils it is much less red than when examined at a greater depth. It is there much less spongy, as well as thinner, although at the same time denser, and gives rise to hairs which are more or less numerous in different individuals, but are always more abundant and longer in strong and vigorous persons. These hairs, which are named *Vibrissæ,* placed at the entrance of the nasal fossæ, strain the air, as it were, in its passage, and prevent the introduction of foreign bodies into these cavities. They are generally black and stiff, and are often bifurcated at their summit, and send off small twigs from each of their sides. They have the same generative organs as the hairs that are observed on other parts of the body. There is distinctly seen in them a thick, white, pearly external capsule, as developed as in the hairs of the chin, which contains a sheath, directly enveloping the root of the hair, surrounded at its upper part by sebaceous follicles infinitely smaller than those of the wings of the nose. These hairs have also internally a kind of canal divided by septa.

1995. In the sinuses, the pituitary membrane is destitute of follicles, and loses much of its red colour, its vessels scarcely appearing to contain any blood in the ordinary state. It is there very thin, especially in the sphenoidal sinuses and ethmoid cells, where it resembles the arachnoid membrane and has no villosities at its surface. The dense and fibrous layer which is united to the periosteum can no longer be observed, and its adhesion to the walls of the sinuses is very slight.

1996. We have already made known the essential organ of smell, the olfactory nerve (1509), which is expanded in the pituitary membrane. This membrane moreover receives a great number of other nervous filaments, which are furnished by the internal nasal nerve of the ophthalmic (1555), the frontal twig of the same trunk (1553), the ganglion of Meckel (1769), the great palatine nerve (1771), the Vidian nerve (1775), and the anterior dental twig of the superior maxillary (1560).

1997. The arteries of the pituitary membrane are furnished by the branches of the internal maxillary artery known under the names of spheno-palatine; by the infra-orbitar, upper alveolar, palatine, and pterygo-palatine; by the supra-orbitar and ethmoidal branches of the ophthalmic artery, the internal carotid artery, the superior labial artery, and the dorsal arteries of the nose. Its veins are little known. They appear in general to follow the course of the arteries. Some of them unite with those of the nose to ascend by the holes with which the bones of that part are perforated (263) towards the commencement of the superior longitudinal sinus of the dura mater (1475). The spheno-palatine veins empty themselves into the internal maxillary veins. Some of those of the sphenoidal sinuses communicate with the coronary sinus of the dura mater (1480). The others open into the angular vein. All these vessels creep almost naked at the surface of the membrane. It is also to be remarked that they scarcely ramify in its fibrous lamina.

1998. The lymphatic vessels of the pituitary membrane are scarcely known. Some principal trunks however have been observed in it, which accompany the blood-vessels, and go to the jugular ganglia.

1999. Of the *Nasal Mucus*. During life, as after death, the olfactory membrane is constantly covered with a thick, viscid, mucilaginous, inodorous humour, of variable colour, more commonly a little yellowish, slightly salt to the taste, bland, and but little soluble in water, even with the aid of heat. It forms a thick layer in the places where the membrane is destitute of epidermis, whereas there is much less of it where it is protected by that envelope, as at the entrance of the nostrils. This mucus is produced by the follicles of the pituitary membrane, and varies in quantity in the different circumstances of life.

ARTICLE FOURTH.

OF THE TONGUE OR ORGAN OF TASTE.

A.—GENERAL CONFORMATION.

2000. The *Tongue*, a symmetrical organ, chiefly muscular and possessed of great mobility, situated in the interior of the mouth, extending from the hyoid bone and epiglottis to behind the incisive teeth, is the organ by which we procure the sensation of taste. This is not its sole use however, for it contributes moreover to the acts of suction, mastication, deglutition, pronunciation, &c.

2001. The tongue varies much in size. Its form is that of a pyramid flattened from above downwards, rounded on its angles, and terminated anteriorly by a blunt point. There are distinguished in it, two surfaces, two edges and two extremities.

2002. *Upper Surface* or *Back of the Tongue*. Entirely free, nearly flat, and covered by the mucous membrane of the mouth, it appears as if divided into two lateral portions by a slight and superficial groove, at the posterior extremity of which, near the base of the tongue, there occurs a considerable depression, varying in form, and which is named the *Foramen cœcum of the tongue.* In some subjects, this hole is wanting; but in others, it has a depth of several lines. It is in its interior that the excretory ducts of the mucous follicles placed in its vicinity terminate. From its sides proceed two lines, varying in form, but always diverging so as to represent a V with its summit directed backwards. These two lines are formed by the mucous follicles. The rest of this surface presents a great number of papillæ, the structure of which we shall expose.

2003. *Inferior Surface of the Tongue.* It is free and invested by the mucous membrane of the mouth in its anterior third and on the sides; but at the middle and posteriorly, it is connected with the lower maxillary bone by means of the genio-glossi muscles, and to the hyoid bone by means of the hyo-glossi. There is observed at its middle part a longitudinal groove which separates two oblong prominences formed by the lingual muscles.

2004. *Edges of the Tongue.* Thick behind and thin before, they are rounded in their whole extent, and present narrow and vertical striæ above, which are parallel to each other, and continuous with papillæ of the dorsal surface.

2005. The *Point of the Tongue,* or its anterior extremity, is rounded and free. Its breadth varies much in different individuals. The *Base of the Tongue*, or its posterior extremity, is continuous with the epiglottis and pillars of the velum palati. From being very thick at the level of the foramen cœcum, it becomes gradually thinner as it approaches the hyoid bone, so that the organ is thinner than anywhere else at the moment when it is attached to that bone.

b. ORGANIZATION OF THE TONGUE.

2006. *Fleshy* or *Muscular Portion.* It forms the greater part of the organ, and is composed of fibres of the stylo-glossi, hyo-glossi and genio-glossi muscles, which we have already described, and of those of an intrinsic fleshy body presenting beneath and on each side two parallel planes which are named the lingual muscles (985). All these muscles have their fleshy fibres interlaced in an inextricable manner, and form at the upper region of the tongue a layer in which it is impossible to decern them, and in which there is interspersed a multitude of small globules filled with an almost fluid fat, placed very close upon each other, which gives them a flattened form, and so much the less red the nearer they approach to the back of the organ. On the sides of the tongue, however, there is still pretty easily distinguished an inferior longitudinal muscular plane, formed by the linguales and stylo-glossi muscles, and another plane lying above the latter, with transverse fibres, formed by the genio-glossi, and surrounded by the proper tissue of the tongue.

2007. At the centre of this fleshy tissue, and in the direction of the median line, there occurs a *fibro-cartilaginous lamina* or *septum*, of a whitish colour, stronger behind than before, having its *upper edge* concealed in the substance of the organ, at a considerable distance from the mucous membrane, and the *lower* free in the interval of the genio-glossi muscles. This septum is continued posteriorly as far as the body of the hyoid bone, and by its two lateral surfaces gives attachment to a great number of muscular fibres.

2008. *Mucous Membrane.* After leaving the posterior part of the lower alveolar arch, and after covering the sublingual glands, the mucous membrane which lines the whole interior of the mouth goes to the under surface of the tongue, forming opposite the symphysis of the jaw (281), a fold of greater or less extent, which covers the origin of the genio-glossi muscles, and which is named the *Frenum Linguæ.* It prolongs itself nearly to the point of the tongue, and allows the ranine veins to be seen on its sides. This fold is accompanied on either side with two denticulated fringes, similar to many other membranous fringes which occur in different parts of the body, and on which my friend M. Beclard proposed, a short time before his death, to publish an interesting work. The mucous membrane then extends on each side beneath the tongue, and ascends upon its edges to pass over its upper surface as far as the epiglottis, where it forms three new folds of which we have already spoken (1390).

2009. So long as it occupies the under surface of the tongue the mucous membrane presents nothing remarkable in its organization. It is very different, however, on the dorsal surface of the organ. There it presents a thin and very distinct epidermis, under which is a layer formed by the intertexture of thousands of vessels, which surround like a net-work the extremities of the nerves and the mucous follicles, and which give the tongue the red colour peculiar to it. Below this vascular layer is the chorion of the membrane, remarkable for its thickness and its adhesion to the muscular body, with which it seems to be incorporated, and to which it affords a great many points of attachment.

2010. At the upper surface of the tongue, the mucous membrane appears moreover rendered rough and uneven by the existence of a great number of eminences differing in their form and nature. These are the *Papillæ,* and are distinguished into three kinds.

1. *Lenticular Papillæ.* Their number varies from nine to fifteen. They are disposed, only at the base of the tongue, in two oblique lines in the form of the letter V, and meeting under an angle at the foramen cœcum (1974). They always project considerably, and are of a very irregular form, generally spherical or oval. They are nothing else than mucous follicles like those of

the velum palati, lips, &c., and which open upon the tongue by very perceptible orifices, either superficially, or at the bottom of a small depression. They receive many filaments of the glossopharyngeal nerves, and are situated above the entrance of the latter into the tongue.

2. *Fungiform Papillæ.* Their number is indeterminate, but always greater than that of the preceding. They are irregularly disseminated near the edges of the tongue, and present a rounded and flattened head, supported upon a short and narrow pedicle. Their colour is whitish. Their true nature is not known.

3. *Conical Papillæ.* These are the most numerous of all.—They occupy the space comprised between the lenticular papillæ, and the edges and point of the tongue. Their arrangement is more regular behind than before. They resemble small cones, attached to the tongue by their base, and free at the summit. The posterior are larger and vertical. The anterior, which are smaller, are a little inclined, and have a more mobile summit. Those which are placed upon the fore part of the edges of the organ are filiform. They appear produced by the expansion of the filaments of the lingual nerve (1568), and are enveloped by a very apparent vascular lace-work. They lie close upon each other, but frequently leave, from space to space, intervals in the form of irregular clefts, which are more frequent anteriorly than posteriorly.

2011. The nerves of the tongue are furnished by the inferior maxillary (1568), glosso-pharyngeal (1598), and hypo-glossal (1625), nerves. The filaments of the two latter belong especially to its muscles or mucous follicles. The first is distributed to the membrane, and to the conical papillæ in particular.

2012. The arteries of the tongue are furnished by the lingual branches of the external carotid arteries, and by the palatal and tonsillar twigs of the labial. Its veins are the superficial lingual, ranine, lingual, and submental. They open into those of the pharynx and larynx. Its lymphatic vessels go to the ganglia situated on the edge of the hyoglossi muscles.

2013. Under the mucous membrane, there scarcely occurs any cellular tissue, unless it be beyond the foramen cœcum, between the fleshy fibres and the glosso-epiglotic folds (1416), where a thick, membraniform layer of it is seen, which never contains fat, and is fixed upon the concavity of the hyoid bone. It is about an inch in length, and receives anteriorly some fibres of the genioglossi muscles and of the base of the tongue.

Between the fleshy fibres of the tongue, there is besides found a very fine fat, more abundant posteriorly than before, and which does not appear to be enveloped by any tissue.

2014. Behind each of the fringes formed under the tongue by the mucous membrane, there is perceived a glandular, amygdaloidal granular mass, of a reddish-gray colour, traversed by a great quantity of blood-vessels, and by filaments of the lingual nerve of the inferior maxillary.

ARTICLE FIFTH.

OF THE SKIN CONSIDERED AS THE GENERAL ORGAN OF TOUCH.

2015. The *Skin* constitutes the general envelope of the body, under the form of a dense, compact, firm membrane, of considerable thickness, very flexible, possessed of great sensibility, exposed to the immediate contact of the air, and perforated opposite the eyes, nostrils, ears, mouth, anus and genital organs, by orifices of greater or less size, but always furnished with more or less strong and apparent hairs. In the circumference of these apertures, it is also always continuous with mucous membranes.

2016. The *outer surface* of the skin is surmounted by a great number of small eminences resembling papillæ, and furrowed with a multitude of wrinkles, some depending upon the action of muscles, as on the forehead and eyebrows, in the palm of the hand and the sole of the foot; others produced by the rows of papillæ, as at the extremities of the fingers and toes, or by the presence of an articulation; or, lastly, by a particular disposition of the cellular tissue, as in the neck.

This surface is covered with hairs which vary according to the regions which they occupy, and which do not exist at all the periods of life. It presents moreover a multitude of pores, of which some are the excretory orifices of sebaceous follicles, whilst the others are exhaling, and absorbent mouths. The latter are scarcely visible without the aid of optical instruments.

2017. The colour of the skin is not the same in the different nations distributed over the globe, and even varies in individuals. It is black in the Negro, copper-coloured in the American, tawny in the Arab, white in the European. In general also, this membrane is finer and whiter in women and children, than in adults and men. In old people, it becomes dry and shrivelled.

2018. The *inner surface* of the skin is connected with the different parts which it covers by a cellular tissue, the nature and disposition of which are not the same in the whole extent of the body. It is in general filled with adipose vesicles (783); but, in some parts, it is absolutely destitute of them, as in the eyelids, scrotum, penis, &c. The adhesion of the skin to the subjacent organs is subject to similar variations, being frequently slight, as in the neck and lower belly, while at other times this membrane furnishes points of attachment to muscles, as on the forehead, and eyebrow, and in the palm of the hand.

2019. The skin is composed of three very distinct layers, the *dermis* or *chorion*, the *rete mucosum*, and the *epidermis* or cuticle.

1. OF THE DERMIS.*

2020. This is the thickest part of the skin. It is of a white colour, and possesses great strength. It rests above the adipose cellular tissue, and is composed of lamellar fibres and alveoli. The latter are similar to those which are observed in the adipose cellular tissue, and appear only smaller. The lamellar fibres are formed by cellular tissue, arteries, veins and nerves, intermingled in an inextricable manner. The tissue which results from this intermixture is firmer and denser externally, softer and looser internally.

The thickness of the skin varies according to the regions of the body, the age and sex. In all the posterior part of the trunk, it has nearly double the thickness that it presents at its anterior part. On the mammæ, penis, scrotum, and labia pudendi, it is remarkable for its thinness. Its inner surface is distinguished from the cellular tissue only by a difference of density. Along the whole median line, excepting on the fore part of the neck, its adhesion is pretty firm, although less intimate than on the palm of the hand or on the sole of the foot. The inner surface also presents apertures by which hairs introduce themselves into the dermis to pass through it. They are nearly a third of a line in diameter, and are more or less numerous. In the adult there are commonly about a hundred of them in the square inch on the thigh, and two hundred on the arm.

The outer surface of the dermis is, in all its regions, covered with more or less distinct prominences, which are separated in the palms and soles by irregular depressions. There these asperities are disposed in parallel, rectilinear, circular or spiral grooves, appearing through the epidermis. Each of them is divided into two smaller ones by a slight longitudinal depression, formed by a series of small excavations to the number of four or five in the extent of a line. The asperites of the dermis are named *Papillæ.*

2. OF THE RETE MUCOSUM.

2021. It consists of four very distinct layers, which are from within outwards: 1st, a vascular tissue; 2dly, a white tissue; 3dly, an assemblage of small granulations; 4thly, another white tissue.

2022. The *First Layer* is essentially formed by the vessels of the skin, disposed in knobs which surmount the asperities of the dermis, to which they adhere, and which, in the sole of the foot and palm of the hand, are arranged in the order of the papillar grooves.

Each of these knobs is formed of small reddish filaments, which issue separately from each of the asperities which exist on the back of the grooves of the dermis. These filaments, which are twelve, fourteen, or eighteen in number, rise at a right angle, and are enveloped with a whitish, somewhat parenchymatous tissue, which unites them into a conical knob, divides to the base into two nearly equal parts. They are slightly flexuous, and much bent upon themselves, but are never interlaced.

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* Δερμα, Χοριον of the Greeks.

From the lateral parts of these knobs proceed small white productions, which penetrate into the second layer. From their summit rise one or two small vessels, which pass through the epidermis, and open at the surface of the skin.

2023. The *Second Layer* rests upon the vascular knobs, and in the intervals of the dermis by which they are separated. In the depression of the grooves, there is seen, after a suitable maceration, a very great number of cylindrical prolongations, placed at regular distances from each other, which issue from this layer to penetrate into the substance of the dermis. Its outer surface presents the same eminences and depressions that are observed on the epidermis.

2024. The *Third Layer* is charged with colouring matter, brown in the Negro, and of an opaque white in the European. It seems composed of a series of small bodies, convex externally, concave internally, and contiguous to each other. Their number is equal to that of the vascular knobs, each of them corresponding by intervention to one of these bodies.

2025. The *Fourth Layer* is white, and of extreme tenuity. It forms a general membranous envelope, perforated by the hairs, and adhering to the epidermis.

3. OF THE EPIDERMIS OR CUTICLE.

2026. This is a dense impermeable envelope, entirely superficial, and separated from the dermis by the rete mucosum, to the fourth layer of which it adheres by its inner surface. The epidermis is of a variable thickness, always in relation to the volume of the vascular granulations, and appears formed of several superimposed layers. It is it that presents all the wrinkles and furrows of which we have spoken in describing the outer surface of the skin. It is thin and transparent, and is not altered by exposure to the air. Its tissue is firm and close; but its intimate structure is yet little known. It seems externally composed of a great number of small scales, placed beneath each other. Exhalant vessels pass through it, without ramifying in it. No nerves or blood vessels are found in it.

2027. The arteries of the skin come by numerous and short ramifications from several trunks concealed in the substance of the muscles or in their interstices, and anastomose in the subcutaneous cellular tissue. They then penetrate into the dermis, to be distributed to the first layer of the rete mucosum (2022), whence issue, moreover, the radicles of the veins of the skin, which are less known than its arteries, and probably also lymphatic vessels. All these vessels, therefore, form above the dermis a layer of which we have spoken, and in which their tenuity is so great that several may be injured at once by the point of a needle.

2028. The nerves of the skin are very numerous and very slender, and cannot be traced beyond the dermis. It is not known how they terminate, although they are supposed to constitute the papillæ.

2029. In the whole extent of the skin, excepting on the palms and soles, there occur a multitude of sebaceous follicles which pour upon its surface an unctuous fluid which keeps up its flexibility, and protects it against the action of external bodies. Their existence is always connected with that of the hairs, so that the places which present most of the latter, such as the skull, the pubes, the axillæ, &c. are also those in which there occurs the greatest quantity of those follicles, of which some are isolated, more voluminous, utricular, and have a very short excretory duct, while the others are much smaller and agglomerated into a crown in the capsule in which the root of each hair is contained.*

CLASS SECOND.

ARTICLE FIRST.

ORGANS OF DIGESTION.

I. OF THE MOUTH, PHARYNX, AND ŒSOPHAGUS, OR OF THE ORGANS OF MASTICATION AND DEGLUTITION.

I. *Of the Mouth.*†

2030. By the *Mouth* (*Os*) is meant a nearly oval cavity, comprised between the two jaws, intercepted laterally by the cheeks, circumscribed anteriorly by the lips, posteriorly by the velum palati, above by the arch of the palate, and below by the tongue. Its vertical diameter is liable to the greatest variations, on account of the motions of the lower jaw; the antero-posterior is more fixed, and only varies through the motions of the lips; the transverse is in the same condition, being limited by the cheeks. All these diameters, moreover, present numerous individual differences. The walls of the mouth and the various organs which it contains, are lined by a common mucous membrane.

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* For most of the facts here delivered with respect to the history of the skin, we are indebted to the researches of the late Dr. Gaultier, who published them in a thesis sustained before the Medical Faculty of Paris in 1811.

† Στόμα of the Greeks.

a. OF THE COURSE OF THE MUCOUS MEMBRANE OF THE MOUTH.

2031. Inferiorly it commences on the free edge of the under lip, of which it lines the posterior surface, to be afterwards reflected upon the body of the maxillary bone. There it forms opposite the symphysis of the chin, a fold which is more developed below than above, and which is named the *Frenum of the under lip.* It is lost insensibly upon the lip. The membrane then sends into each alveolus a prolongation which strengthens the insertion of the roots of the teeth, and is continuous with a membranous lamina which lines these cavities. From thence it proceeds over the posterior surface of the body of the inferior maxillary bone, forms opposite the symphysis the *Frenum* or *Bridle of the tongue* (2007), covers, as we have said, the whole surface of that organ, gains the epiglottis, and is continued into the mucous membrane of the larynx (1417) and that of the pharynx.

2032. Superiorly it commences on the free edge of the upper lip, forms between it and the superior maxillary bones a *bridle* similar to that of the lower lip, gains the upper alveolar arch, sends prolongations into the corresponding alveoli, passes to the vault of the palate, of which it closes the anterior foramen and the two posterior holes, receives the nerves and vessels which pass through them, and is reflected over the fore part of the velum palati, on the free edge of which it is continuous with the pituitary membrane (1988).

2033. On either side, this membrane, proceeding from the commissure of the lips, lines the cheeks at the middle of which it presents the orifice of the parotid duct, and proceeds over the branches of the inferior maxillary bone, forming a vertical fold at the level of their anterior edge. At the backmost part, it turns over the glosso-staphylini (1017) and pharyngo-staphylini muscles (1014), to form the pillars of the palatal vault, between which it covers the tonsils. Beyond this it is continuous with the membrane of the pharynx.

2034. The mucous membrane of the mouth presents numerous variations of structure, according to the region of the cavity in which it is examined, there may, however, be assigned it as a general character, that it contains in its substance a great quantity of mucous follicles, which even seem to form a particular membranous layer in some places, and that it is covered by a very distinct epidermis.

b. OF THE LIPS, OR ANTERIOR APERTURE OF THE MOUTH.

2035. The *Lips (Labia)* are two moveable veils, composed of various muscular bundles, interspersed with nerves and vessels, and covered by the skin and common mucous membrane of the mouth, which terminate that cavity anteriorly, and are subservient to the mastication of the food, and to the pronunciation of words. The lips, which are distinguished into upper and under, are placed before each of the maxillæ, and have a thickness subject to numerous individual variations, but peculiarly great in the negro. Between them is a transverse slit, which is the *anterior aperture of the mouth.*

The upper lip, which is generally a little more advanced than the other, presents anteriorly and in the middle, a vertical groove, rather broad but shallow, which seems to be continuous with the septum of the nose (1986). Posteriorly, it is covered by the mucous membrane, which there forms a particular fold. Its free edge, which is directed downwards, is rounded and covered with a very thin red pellicle, on which are observed some wrinkles directed across the lips, and a very distinct epidermis. At the middle part of this edge there exists a small prominence, limited laterally by two depressions which are more or less distinct according to the subject.

The under lip presents, anteriorly and in the median line, a very slight vertical prominence, and a transverse depression of considerable extent, which separates it from the chin. Posteriorly, it is covered by the mucous membrane of the mouth, which forms a bridle for it much shorter than that of the upper. Its free edge is also larger than that of the upper lip; it is directed upwards, depressed in the middle, somewhat prominent on either side, and in other respects precisely similar to the upper.

The under lip has less vertical extent than the upper. Both are laterally united by means of two acute angles, which are called their *commissures.* These commissures, which are a little depressed, present no trace of fibrous tissue, and are entirely fleshy.

2036. *Dermal layer of the lips.* The skin which covers the lips differs in nothing from that which is met with in the other parts of the body; only it is much thinner and more delicate. The cellular tissue which connects it with the subjacent parts contains no fat. In the adult male it is covered with a greater or less quantity of hair; in the female it does not present the same disposition, excepting in some rare instances. On the upper lip, these hairs are very numerous, and form two oblique rows, meeting under the nose, and prolonged as far as the commissures. It is what is called the *moustaches.* On the under lip they are not so thick, and form part of the *beard*, properly so called. They are especially numerous in the depression which separates it from the chin.

2037. *Muscular layer of the lips.* This has been already described. It is formed in the upper lip, by the levator labii superioris alæque nasi, levator proprius, zygomaticus minor, and depressor alæ nasi, on either side; in the under lip, by the quadratus genæ and levator menti; in the commissures, by the buccinator, triangularis, levator anguli oris, and zygomaticus major; lastly, their free edge is especially constituted by the orbicularis oris.

2038. *Mucous layer of the lips.* Here the mucous membrane is remarkable for its redness, the small number of villosities which appear upon its surface, and its very distinct epidermis. Between it and the muscular layer, there occur a multitude of large mucous follicles, rounded and prominent, mostly separated from each other, and opening by a very distinct orifice upon the posterior surface of the lips. They are commonly named *labial glands.*

2039. The arteries of the lips are all furnished by the external carotid, and in particular by its labial, submental, mental, buccal, infra-orbitar, alveolar, and transverse branches. The veins correspond to them, and open into the two jugular veins. Their lymphatic vessels descend towards the ganglia which are situated beneath the chin, in the course of the submental artery. Their nerves are supplied by the infra-orbitar (1587), mental (1599) and facial (1614) nerves.

c. OF THE VELUM PALATI AND POSTERIOR APERTURE OF THE MOUTH.

2040. The *Velum palati* is a soft, broad, thick mobile partition, appended to the extremity of the vault of the palate, and separating the mouth from the pharynx. Its form is nearly quadrilateral. Its two surfaces, the *anterior* and *posterior*, are smooth, and present nothing remarkable, unless it be the anterior, which offers at its middle part a small prominence formed by the palato-staphylinus muscle (1013). Their direction varies according to the motions performed by the velum palati. Its *upper edge* is very thick and fixed to the vault of the palate; the *lower edge* is free and floating beneath the base of the tongue. It presents at its middle part an appendage or prolongation which is named the *Uvula.*

The uvula is of a conical form, and varies in volume and length in different subjects. It forms the inferior edge of the velum palati into a double arch, terminated on each side by two pillars which are continuous with the tongue and the pharynx.

These pillars of the velum palati are placed the one before the other, and separated by a triangular space in which are lodged the tonsils. They are united above, but diverge below. The anterior is oblique, and contains in its substance the glosso-staphylinus muscle. The posterior is nearly vertical, and formed by a portion of the pharyngo-staphylinus muscle internally.

2041. *Mucous Layer of the Velum Palati.* It forms a kind of duplicature in which is contained the muscular layer, and is continued anteriorly into the membrane of the mouth, and posteriorly into those of the nasal fossæ, so that the palatal and pituitary membranes unite upon the free edge of the velum palati. The anterior lamina of this layer is less red than the posterior, and covers a multitude of mucous follicles, which are extended over the fore part of the muscles, and are so close as to be in contact with each other. They form of themselves nearly the whole thickness of the uvula. They are yellowish, rounded, and compressed; their excretory orifice is not easily perceptible. These follicles are much less numerous, and of smaller size, under the posterior lamina.

2042. *Muscular Layer.* The muscles of which it is formed have already been described. They are the peristaphylini intern and externi (1007), the glosso-staphylini (1017), the pharyngo-staphylini (1014) and the palato-staphylinus (1013).

2043. The arteries of the palate are furnished by the internal maxillary, labial and superior pharyngeal arteries. Its veins unite with those of the tongue and pharynx, and open into the jugular vein. Its nerves are furnished by Meckel's ganglion, and come from the palatine twigs (1799). The glosso-pharyngeal nerve also furnishes some filaments to it (1628).

2044. Beneath the velum palati is the posterior aperture of the mouth, of which the form is nearly quadrilateral, and which is limited by the base of the tongue, the velum and arch of the palate, and the lateral pillars of the velum, as well as the tonsils. Its size is in no case equal to that of the anterior aperture. It is howeve subject to vary, but only from above downwards, for on the sides it is limited by the pterygoid processes, which are incapable of motion.

d. OF THE TONSILS.

2045. The *Tonsils (Tonsillæ, Amygdalæ)* are bodies lodged between the pillars of the velum palati, the form of which has been compared to that of an almond invested with its woody covering. Their size varies in different subjects, which is also the case wit their figure. They represent an ovoid, of which the *large extremity*, directed upwards, corresponds to the point at which the pillar of the velum meet, while the *small extremity*, which looks downwards, rests upon the base of the tongue. Their *external surfac* adheres to the constrictor pharyngis superior muscle. The *internal*, which is convex and free, projects more or less, and constitute the sides of the isthmus of the fauces. Their *anterior edge* is applied against the glosso-staphylinus muscle, and the posterior agains the pharyngo-staphylinus.

2046. The tonsils seem to be continuous with the mucous follicles of the base of the tongue (2007), and are divided into several lobes, sometimes continuous and sometimes separated from each other. They have a grayish colour, more or less tinged with red, and appear formed by a pulpy tissue resembling that of its follicles. They are filled internally by cellules which manifestly open on their inner surface, where their orifices, which are very large, are distinctly seen. These cellules, which vary much in their form and disposition, are larger above than below. They communicate most commonly with each other, but are also sometimes isolated. The mucous membrane of the mouth introduces itself into them and lines their wall. In their bottom excretory ducts are observed to open, which come from a mass of follicles which forms the substance of the tonsil externally.

2047. The arteries of the tonsils come from the lingual, inferior, palatine, and internal maxillary arteries. Their nerves are furnished by the *Circulus tonsillaris*, which is formed by the lingual and glosso-pharyngeal nerves (1628). The nature of the fluid separated by these organs is still unknown, although it appears analogous to the other mucous humours. The cellules of which we have spoken form reservoirs for it.

e. OF THE CHEEKS.

2048. The *Cheeks (Genæ)* form the lateral walls of the mouth, without, however, constituting a particular and distinct organ. Externally they have no precise limits; above, they are continuous with the prominence of the cheek and the lower eyelid; below, they descend as far as the base of the jaw; and, anteriorly, terminate at the wings of the nose and the parotid gland. Internally they are distinctly limited, above and below, by replications of the mucous membrane of the mouth, which leaves them to gain the maxillary bones; posteriorly, by the anterior pillars of the velum palati; and, anteriorly, by the commissure of the lips.

Their thickness varies much according to the condition of the individual. Pretty frequently, they form a projection outwards, and sometimes they seem to fall in on the side next the mouth..

2049. *Dermal Layer of the Cheeks.* The skin which covers the cheeks is very delicate, and, in the adult male, is covered with a great quantity of hair, which partly constitutes the *Beard.* We observe, however, that this hair does not exist in its middle region, so that there it is perfectly bare. It also appears in this place to contain a great quantity of blood-vessels, and is generally more coloured than elsewhere. It is commonly separated from the buccinator muscle by a great quantity of fat, which even frequently forms an isolated mass.

In old people and valetudinarians, the cheeks are frequently furrowed with wrinkles, which do not exist in young subjects or persons in good health.

2050. *Muscular Layer.* It is composed of the buccinator, masseter, zygomaticus major and minor, and a portion of the platysma myoides. Between the zygomaticus major and the buccinator, there also occurs a great quantity of soft and yellowish fat, contained in a very loose cellular tissue.

2051. *Mucous Layers.* Here the common membrane is thinner than in the other parts of the mouth. It covers a great number of follicles, which are commonly named *Buccal Glands.* They have the greatest resemblance to those of the lips (2038). Their orifices are irregularly dispersed over the inner surface of the cheek, and are easily distinguished from that of the parotid duct, which is marked by a particular prominence at the middle of this region, near the third grinder of the upper jaw.

At the back part, between the masseter and buccinator muscles, are two small bodies formed of the assemblage of several of these follicles. They are designated by the name of *Molar Glands*, because the orifice of their excretory duct is situated opposite the last molar tooth.

2052. The arteries of the cheeks come from the labial, transverse, buccal, upper alveolar, and infra-orbitar arteries. The veins correspond to them, and discharge themselves into the two jugular veins. Their lymphatic vessels go to the ganglions of the neck. Their nerves are supplied by the infra-orbitar, facial, buccal, and masseteric nerves. Some of them come also from the cervical plexus.

f. OF THE PALATE.

2053. The *Palate (Palatum Fornix Palati)* is the upper wall of the mouth, limited anteriorly by the adhering edge of the upper lip, posteriorly by the base of the velum palati, and laterally by the cheeks. It represents a kind of parabolic arch, a little longer than broad, horizontal, but slightly hollowed, and perfectly fixed. A white line, slightly depressed, traverses the palate from before backwards, and in the course of the median line of the body. At the anterior extremity of this line, between the two middle incisiors of the upper jaw, is a small tubercle which corresponds to the inferior orifice of the anterior palatine canal (328).

2054. *Bony Portion of the Palate.* It is formed by the upper alveolar arch, the inferior surface of the palatal processes of the superior maxillary bones, and the horizontal portions of the palate bones; and has already been fully described (332).

2055. *Palatine Membrane* and *Gums.* On the vault of the palate, the common mucous membrane is denser, thicker, and less red than in the other parts of the mouth. At its anterior part, it presents transverse rugosities, varying in number and extent, and at this place it is thicker than behind. In the rest of its extent, it is smooth and interspersed with numerous holes, which are the orifices of mucous follicles situated between it and the bony arch of the palate. These follicles become more numerous as we approach the velum. In their intervals, very distinct prolongations connect the periosteum with the mucous membrane, so as to render the latter perfectly motionless. It is between the two laminæ which result from this union that the nerves and vessels creep.

The membrane of the palate is continuous anteriorly, and on the sides, with the gums, which are formed of a kind of firm and compact reddish tissue, covering the two sides of each alveolar arch, and filling the intervals which remain between the teeth, the necks of which they closely surround. The gums are continued anteriorly into the internal membrane of the cheeks and lips. Their intimate nature is rather difficult to be made out. They are confounded with the periosteum, receive blood-vessels, and appear composed of two layers, a pulpy and a fibrous, covered by the mucous membrane. No follicles are discovered in their substance; but the mucous membrane which enters into their constitution, is prolonged into the alveoli, and from the bottom of these cavities, sends into the cavity of each of the teeth a bulbous prolongation which exactly fills it, and which has been named the *pulp* or *nucleus* of the tooth (323). Bonn, Walther, and Lavagna first pointed out this fact, which is now generally admitted.

2056. The arteries of the palate and gums come from the palatal, alveolar, infra-orbitar, labial and buccal branches, and for the lower gums in particular, from the submental and mental. The veins correspond to the arteries. The nerves are furnished by the palatine (1799), facial, infra-orbitar, superior and inferior dentar nerves, and by the naso-palatine ganglion (1823).

2. *Of the Pharynx.**

a. GENERAL CONFORMATION.

2057. The *Pharynx* is a kind of musculo-membranous, symmetrical canal, placed in the median line of the body, and irregularly funnel-shaped. It extends from the base of the skull to near the middle of the neck. Limited *above* by the basilar process of the occipital bone, it is continuous *below* into the œsophagus, and *anteriorly* with the nasal fossæ, the mouth, and the cavity of the larynx, corresponding to the velum palati in their interval. *Posteriorly*, it rests upon the vertebral column and the longi colli and recti capitis antici muscles. On *its sides*, it is in contact with the common and internal carotid arteries, with the internal jugular veins, the pneumo-gastric nerves, and, at its uppermost part, with a small portion of the internal pterygoid muscles. It is connected with those different parts by a lamellar cellular tissue, destitute of fat, and very extensile.

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* Φάρυγξ of the Greeks.

2058. The cavity of the pharynx, which is of a form that cannot be precisely described, has no wall anteriorly, at the level of the nasal fossæ and mouth. Vertically elongated, it is narrow above, where it is limited on each side by the pterygoid processes. In the middle, it becomes much wider, extending there as far as the great horns of the hyoid bone and the thyroid cartilage. Below, it gradually contracts until opposite the trachea, where the œsophagus commences. From this disposition, the pharynx really exists only behind. It is therefore in reality rather a mere half cavity than an entire cavity. From the base of the skull to below the aperture of the larynx, its walls are always separated, while farther down they are in contact with each other.

2059. The *Inner Surface* of the pharynx may be viewed as consisting of several walls. The *posterior*, which is flattened, presents nothing remarkable, and may be perceived at the bottom of the mouth when the latter is opened. The *anterior* presents above the posterior apertures of the nasal fossæ, at the middle the posterior surface of the velum palati and uvula, farther down the guttural aperture of the mouth, the base of the tongue, the epiglottis, the entrance of the larynx, and lastly the posterior surface of that organ. The two *lateral walls* are narrow. There is observed the pavilion of the Eustachian Tubes (1943), close upon the apertures of the nasal fossæ.

2060. *Above*, the pharynx is attached in a solid manner to the basilar process by the cephalo-pharyngeal aponeurosis, to which are attached some of the fibres of the superior constrictors of the pharynx (1049). Stronger and denser at the middle than on the sides, it there constitutes of itself the firm part of the organ. It is gradually confounded below with the mucous membrane.

2061. *Inferiorly*, the separation of the pharynx from the œsophagus is indicated by a sudden contraction at the exterior, and rendered very remarkable by a change in the direction of the muscular fibres.

b. ORGANIZATION OF THE PHARYNX.

2062. *Muscular Layer.* The muscles of which it is composed are the six constrictors, the two stylo-pharyngei (1053), and the two pharyngo-staphylini (1014), all which have been already described. We only observe that their fibres, which differ in their obliquity, form planes which cross each other in different directions.

2063. *Mucous Membrane.* It is continuous above with the pituitary membrane, in the middle with the membrane of the mouth, below with those of the larynx and œsophagus, and on the sides with those of the Eustachian tubes. After covering the cephalo-pharyngeal aponeurosis and the posterior wall of the pharynx, to the muscles of which it is attached by a rather loose cellular tissue, it is prolonged over the arch of the palate, is reflected upon its pillars, sinks into the two spaces which separate laterally the thyroid and cricoid cartilages (1419), lines the posterior part of the latter, passes over the sides of the larynx, and is applied upon the arytenoidei, crico-arytenoidei postici and thyro-arytenoidei mucles (1412).

This membrane has a very decided red tint. It is smooth, destitute of villosities, and presents only a few inequalities arising from the presence of the mucous follicles. It is evidently thicker above than below. It is covered with a very thin epidermis, and is folded in the part which corresponds to the larynx. A multitude of capillary vessels are scattered over it. Its follicles are more numerous above than below. They are of an oval form and pretty large, and their orifices are very distinct.

2064. The pharynx receives on each side two principal arteries, the superior and the inferior pharyngeal, the former coming from the external carotid, the other from the internal maxillary. The inferior palatal and superior and inferior thyroid arteries also send some ramifications to it. Its veins go to the internal jugular, thyroid, and labial veins. Its lymphatics direct themselves towards the ganglia, placed near the bifurcation of the internal jugular vein. Its nerves come from the glosso-pharyngeal and pneumogastric nerves, and from the superior and middle cervical ganglia, the interlaced filaments of which constitute the *Pharyngeal Plexus* (1634).

*Of the Œsophagus.**

a. GENERAL CONFORMATION.

2065. The *Œsophagus* or *Gullet (Gula)* is a musculo-membranous canal, which extends from the lower part of the pharynx to the superior orifice of the stomach. It commences therefore towards the fifth cervical vertebra, and terminates between the crura of the diaphragm. Its general direction is vertical; but presents some partial inflections. At its commencement, immediately under the pharynx, it is placed upon the course of the median line, which it leaves under the larynx to deviate to the left, so that, at the lower part of the neck, it is placed behind the corresponding side of the trachea. On entering the thorax, it approaches its original direction as far as the origin of the bronchi, where it regains it entirely, and continues in it to the moment when it leaves that cavity. It then directs itself again to the left, passing into the abdomen, where it terminates after a very short course.

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* Ὄιω, *fero ;* φάγω, *comedo.*

2066. This canal is cylindrical and slightly compressed from before backwards whilst empty. It is connected with the neighbouring parts by an extensile cellular tissue, which is very loose, and contains some lymphatic ganglia.

2067. In its *cervical portion*, the œsophagus corresponds, *anteriorly* and from above downwards, to the larynx, the left lobe of the thyroid body, the left half of the trachea, the left inferior thyroid vessels, whose direction it crosses, and the sterno-thyroideus muscles; *posteriorly*, to the anterior common vertebral ligament and the longus colli muscle of the left side; *laterally*, at first to the common carotid arteries and internal jugular veins, and afterwards on the right side to the trachea, and on the left to the recurrent nerve and carotid artery of that side.

2068. In its *thoracic portion*, the œsophagus, which is here entirely contained in the posterior mediastinum, corresponds *anteriorly*, in part to the trachea, then entirely to the left bronchus, whose direction it crosses, and lastly, to the base of the heart and the posterior part of the pericardium; *posteriorly*, to the vertebral column, the curve of the vena azygos, the thoracic duct, and at its lowest part to the aorta; while *laterally*, it lies near the lungs, having the aorta to the left.

2069. This canal is a little wider at its origin than in the rest of its extent, excepting however at the moment when it joins the stomach. Its *outer surface* is smooth in its whole extent; reddish above, and assuming a white tint as it descends. It presents numerous parallel longitudinal striæ. Its *inner surface* is much whiter than that of the pharynx, and always presents longitudinal folds.

b. ORGANIZATION OF THE ŒSOPHAGUS.

2070. Like the pharynx, the œsophagus is composed of a muscular coat and a mucous membrane.

2071. *Muscular Coat.* It is thicker and stronger than the fleshy coat of the pharynx, and especially than those which are observed in the stomach and intestines. It is obviously formed of two planes of fibres, an external and internal. The fibres of the former are longitudinal, and seem to come in part from the sides of the cricoid cartilage, so that, superiorly and behind, they present a separation in which those of the inner plane are seen exposed. These last are transverse, annular, frequently interrupted in the circle which they describe, and not so close as the preceding. The highest are disposed in small distinct bundles connected by cellular tissue. They are of a red colour. But in the rest of the canal, the fibres of the two orders are placed close upon each other, and are only separated by cellular tissue. Their redness besides diminishes much, and at length they even become almost white.

Towards the stomach, the longitudinal fibres expand and diverge in a sensible manner, so that the internal mucous membrane is distinctly seen in the intervals of their bundles. They are continued upon the stomach, while the circular fibres entirely cease.

Between the muscular coat and the inner membrane of the œsophagus, there is found a layer of dense and compact cellular tissue, which never contains fat.

2072. *Mucous Membrane.* It is soft, spongy, delicate, rather thin and white, especially below. It is continuous above with the membrane of the pharynx, but not with that of the stomach below. In its whole extent, and in the empty state of the organ, it presents more or less numerous longitudinal folds, arising from the contraction of the muscular coat, and frequently running into each other. In the substance of these folds there are prolongations of the cellular tissue of which we have just made mention, and to which the older writers gave the name of *Nervous Coat.* On their projecting surface are seen minute tubercles or rather villosities of a cylindrical or conical form, resembling on a small scale the papillæ of the tongue.

2073. The mucous follicles of the œsophagus are much smaller and less numerous than those of the pharynx. They are thinly scattered in the cellular tissue lying between the two layers which form it. Their orifices are very small, and occur in the depressions which separate the longitudinal folds. They are sometimes called *œsophageal glands.* They are surrounded by a circle of tubercles or villosities.

2074. The arteries of the œsophagus are in general of inconsiderable size. They come in the neck from the inferior thyroid arteries; in the thorax, from the bronchial and directly from the aorta; in the abdomen, from the inferior diaphragmatic arteries and from the coronary artery of the stomach. Its veins terminate in the inferior thyroid veins, the superior vena cava, the internal mammary veins, the vena azygos, the bronchial and phrenic veins, and the coronary vein of the stomach. The lymphatic vessels go to the ganglia which surround it. Its nerves are furnished by the pharyngeal and pulmonary plexus (1640), the cardiac nerves (1823), the thoracic nervous ganglia (1833), and especially the pneumo-gastric nerves and their recurrent branches (1638). All these nerves form around it a large plexus which envelopes it the whole way to the stomach.

II. *OF THE STOMACH AND INTESTINES, OR ORGANS BY WHICH THE CHYME AND CHYLE ARE ELABORATED.*

1. *Of the Stomach.*

a. GENERAL DISPOSITION.

2075. The *Stomach* (*Ventriculus*),* the principal organ of digestion, is a conical, elongated musculo-membranous reservoir, curved from before backwards and from below upwards in the direction of its length, slightly depressed on two opposite sides, continuous on the one hand with the œsophagus, on the other with the duodenum, situated beneath the diaphragm, between the liver and spleen, behind the left false ribs, occupying, at the upper part of the abdomen, the epigastrium and a portion of the left hypochondrium, and destined to convert the alimentary substances into chyme before transmitting them to the intestines.

2076. The volume of this viscus is liable to change much in the different circumstances of life, so that very frequently it is no longer concealed by the false ribs, but descends beneath them, behind the parietes of the abdomen. This happens in particular when it is much distended with food. In general, also, the stomach is larger in individuals who eat much than in other persons.

Its greatest diameter is transverse. The small diameter, which is vertical, gradually diminishes in proceeding from the œsophagus towards the duodenum. Its two orifices are considerably contracted, and are directed upwards and backwards.

Its direction is generally nearly transverse, and only a little inclined downwards, to the right and forwards, so that its right extremity is a little anterior and inferior to the left. When the viscus is filled with food, this obliquity is increased, and the stomach approaches the vertical direction.

2077. There are distinguished in the stomach an outer surface, an inner surface, two curves or edges, and two extremities, each having an orifice, a larger to the left, and a smaller to the right.

OF THE STOMACH CONSIDERED AS TO ITS EXTERIOR.

2078. Its *anterior surface*, which is more convex than the posterior, and is turned a little upwards in the state of repletion, corresponds, from right to left, to the left lobe of the liver, to the diaphragm and the false ribs, and in the state of distention only, to the anterior wall of the abdomen, over a greater or less extent. It is always inclined downwards and forwards.

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* Γαστήρ of the Greeks.

2079. Its *posterior surface*, which is flat, oblique, like the preceding, but of less extent than it, and directed downwards when the organ is full, is always entirely concealed in the posterior cavity of the omentum, and is in connection with the transverse mesocolon, and sometimes even with the arch of the colon and the duodenum.

2080. These two surfaces are smooth and polished, continually moistened, traversed by a great number of blood vessels, and of a whitish colour.

2081. *Great Curvature of the Stomach.* This name is given to the place where the two surfaces of the stomach meet externally downwards and forwards. The kind of edge here produced is convex, and extends from the one orifice to the other. In the vicinity of the spleen, and to the left, its convexity is greater than elsewhere. It corresponds to the transverse mesocolon and to the arch of the colon. It is as it were lodged in a separation of the lamellæ of the anterior lamina of the great omentum, so that, in the empty state, the peritoneum is not exactly applied upon it. It is to this space that the right and left gastro-epiploic arteries, and a certain number of lymphatic ganglia correspond.

To the right, the great curvature of the stomach forms a kind of bend, which corresponds to an internal depression, which is named the *Small Cul-de-Sac.* To the left, it presents a considerable prominence, named the *Tuberosity* or *Great Cul-de-Sac of the Stomach*, which, placed beneath the œsophageal orifice, is prolonged into the hypochondrium, and diverges from the general direction of the viscus. It increases its length in a decided manner, and corresponds to the anterior half of the internal surface of the spleen, with which it is connected by a fold of the peritoneum, which lodges the vasa brevia.

2082. *Small Curvature of the Stomach.* It is concave, and unites the two surfaces of the stomach above and behind. It corresponds to the aorta, the great fissure and lesser lobe of the liver, and extends from the one orifice to the other, without presenting either dilatation or cul-de-sac, on which account its dimensions are smaller than that of the great curve. But, like it also, it is not immediately invested by the peritoneum. It in fact sinks between the two laminæ of the hepato-gastric omentum, and is coasted by the coronary artery.

OF THE INTERNAL SURFACE OF THE STOMACH.

2083. It is of a reddish white colour, having a marbled appearance, constantly covered with a thick mucosity, and lined by the mucous membrane. Its form corresponds perfectly to that which the viscus presents at its exterior; only, there are observed upon it numerous and irregular wrinkles, which disappear when the organ is full. It is covered with a very abundant viscid humour.

OF THE EXTREMITIES AND ORIFICES OF THE STOMACH.

2084. Of the *Cardia (Cardiac, Left* or *Œsophageal Orifice).* It separates the two curves to the left, and is placed beneath the diaphragm, and above the large extremity of the stomach, at the union of the two right thirds and the left third of that viscus. It is in it that the œsophagus terminates. It is surrounded by a circle formed by the coronary artery and vein, and by the extremities of the œsophageal cords of the pneumo-gastric nerves (1641). It is also in relation with a part of the left lobe and lobulus Spigelii of the liver, and with the corresponding anterior edge of the vertebral column.

2085. Of the *Pylorus* (Pyloric, right* or *intestinal orifice).* It is situated in the epigastrium, lower and more anteriorly than the cardiac orifice. It terminates the stomach to the right, forming the summit of the cone represented by that viscus, and makes it communicate with the duodenum. Placed in the direction of the two curves at once, it commences by a funnel-shaped expansion, and terminates abruptly by a circular contraction. It generally ascends backwards and a little to the right as far as the union of the two fissures of the liver. It corresponds above and before to the liver, below and behind to the pancreas, posteriorly and directly to the right gastro-epiploic artery, and on the right side to the neck of the gall-bladder. It is often coloured by the transudation of the bile through the walls of that reservoir, and is always surrounded by a great number of vascular twigs and nervous filaments.

3. ORGANIZATION OF THE STOMACH.

2086. The walls of the stomach are formed by three superimposed membranes, a serous, a muscular, and a mucous. There also enter into their composition cellular tissue, vessels and nerves.

2087. *Serous Membrane* or *Coat.* It is formed by the peritoneum, and does not exist along the curvatures when the stomach is empty, as we have already said. There results from this disposition that the stomach, in the state of vacuity, is no longer covered by portions of peritoneum which were in connection with it during its distention by the food or by any other cause; for it is then prolonged between the laminæ of the omenta, which leave in their whole contour a free space circumscribed by vessels.

Here also, as in the rest of its extent, the peritoneum is white, transparent, smooth, and externally lubricated by a serous fluid. It is united to the muscular membrane by a cellular tissue, which is very loose on the edges of the stomach, but very dense in the middle part of its two surfaces, where there is an intimate adhesion.

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* Πὺλη *porta;* Ουϱος, *custos;* that is to say, *a porter.*

2088. *Muscular Membrane* or *Coat.* It is very thin, and differs essentially in this respect from the muscular coat of the pharynx and œsophagus. It is composed of fasciculi of soft whitish fibres, never red, placed beside each other, and running in three different directions. 1st, Some of these fibres, which are more superficial, are *longitudinal.* Less numerous and less uniformly diffused than the others, they form the continuation of the external muscular layer of the œsophagus (2071), which may be satisfactorily seen on examining them near the cardiac orifice, where they are found to separate from each other. The principal fasciculi form a bundle which runs along the small curvature as far as the pylorus. Another bundle descends on the great cul-de-sac, and is prolonged in the direction of the great curvature. Those which are expanded over the two surfaces of the stomach are much shorter and irregularly disposed. Some of these latter collect, however, into two small bands, the one before, the other behind, which arrive at the pylorus after a course of about an inch. 2dly, The fibres of the second kind, lying immediately under the former, are *circular,* and belong peculiarly to the stomach. They appear to have no connection with those of the œsophagus. Less numerous at the cardia than on the rest of the stomach, and especially at the middle, and running parallel to each other, they never entirely encircle the stomach; but it is very difficult to assign their precise points of origin or termination. 3dly, Lastly, the fibres of the third kind are *oblique.* They constitute two broad bands, one of which extends from the left side of the cardia over the two surfaces of the stomach, while the other is prolonged from the right side of the cardia over the great extremity, where it seems to replace the circular fibres, which occur there only in small number.

A layer of dense and close filamentous cellular tissue unites the muscular to the mucous membrane. This layer the older writers improperly named the *nervous coat.*

2089. *Mucous Membrane* or *Coat.* It is of this membrane that the inner surface of the stomach is formed. Soft, spongy, of a reddish white colour, having a marbled appearance, covered with villosities which seem to constitute a downy and coloured tissue, continually covered with an abundant inodorous viscid fluid, it presents numerous and purely accidental irregular wrinkles when the stomach is empty. When examined with a lens, especially at some distance from the orifices, it is found to be perforated with a multitude of holes disposed pretty regularly in quincuncial order, not more than a fifth of a line in diameter, and thus constituting a kind of reticular warp, the tissue of which recurs between the folds and villosities of the mucous membrane of the duodenum, and around Peyer's glands or follicles. It does not at all appear to be a continuation of the outer membrane of the œsophagus, its appearance and tissue being entirely different, and there being even a kind of line of demarcation perceived between the two membranes. The longitudinal folds which that of the œsophagus forms terminate at the cardia by so many mammellæ or tubercles. Besides, the mucous membrane of the stomach is thicker than that of the œsophagus, which is not covered with villosities.

2090. Between the muscular and mucous coats of the stomach, and along the two curvatures only, are observed mucous follicles, of small size, and opening on the inside of the viscus by sunk and not very apparent orifices. They are commonly called *Brunner's Glands*, from the name of an anatomist who first described them.

2091. At the place where the pylorus presents the least width, there occurs internally a circular rim, which is flattened and perpendicular to the walls of the orifice. It has been improperly called the *Valve of the Pylorus*. It is merely a replication of the muscular and mucous coats of the stomach, which corresponds by one of its surfaces to the cavity of that viscus, and by the other to that of the duodenum, and of which the small circumference is thin, free and floating, so as to circumscribe a narrow aperture by which the food passes into the intestines. But its great circumference is formed by a particular fibrous ring, of a solid texture and white colour, placed between the two forementioned membranes. This ring is the *Pyloric Muscle* of some authors.

2092. The arteries of the stomach are very numerous and very large, compared with the volume of the organ and the thickness of its walls. They come from the two gastro-epiploic, the pyloric, the coronary, and the splenic arteries. They creep at first in the cellular tissue between the peritoneal and muscular coats; but their secondary divisions pass through the latter, and their ultimate ramifications form a very delicate network in the substance of the mucous membrane. These arteries are extremely flexuous, on account of the changes of volume to which the stomach is exposed.

The veins of the stomach bear the same name, and follow the same course as the arteries. They pour their blood into the trunk of the vena portæ, or into one of its principal branches. Like the arteries, they anastomose with each other a great number of times.

2093. The lymphatic vessels of the stomach arise at its inner surface or outer surface, and present for the most part their principal trunks under the peritoneum. They may be referred to three orders. They go particularly to the ganglions placed along the two curvatures, as we shall make known afterwards.

2094. The nerves of the stomach come particularly from the pneumo-gastric nerves (1642), and the three divisions of the cœliac plexus (1845).

2. *Of the Duodenum.*

a. CONFORMATION AND GENERAL DISPOSITION.

2095. The *Duodenum*,* by which the intestines properly so called commence, immediately succeeds to the stomach. It is less voluminous than that organ, but has a greater diameter than the rest of the digestive canal, and is susceptible of great dilatation. It occupies the deep middle part of the abdomen, where it is concealed by the transverse mesocolon or by the stomach.

2096. The direction of the duodenum is such that it may be divided into three portions. The first, which is about two inches long, commences at the valve of the pylorus (2091), proceeds horizontally backwards and to the right, and ends near the neck of the gall-bladder, uniting angularly with the second, which has a variable length, and which descends vertically and a little to the left, as far as the third lumbar vertebra. The third portion is directly continuous with the second, with which it does not form an angle. It proceeds transversely to the left, before the vertebral column, and ends with being directed upwards and forwards, toward the upper extremity of the mesentery, above the superior mesenteric vessels, which cross its direction, and which are embraced by a kind of curve which it forms for them.

The first portion is covered, in the greater part of its extent, by the peritoneum, and is in connection with the hepato-gastric omentum. It is often tinged yellow by the transudation of the bile. The second has no other connection with the peritoneum than that of being covered by the upper lamina of the transverse mesocolon. The third is contained between the two laminæ of that fold.

From this disposition, the duodenum forms a kind of semicircle which circumscribes the pancreas, and has its concavity to the left, and its convexity to the right. It only appears to be kept in a fixed position in its two inferior thirds.

2097. The relations of the duodenum to the neighbouring organs are the following: *above*, it corresponds to the liver and part of the neck of the gall-bladder; *below*, it is limited by the inferior lamina of the transverse mesocolon; *anteriorly*, it is covered by the superior lamina of this fold inferiorly, and by the stomach and right extremity of the arch of the colon above; *posteriorly*, it is applied upon the anterior and right lateral parts of the vertebral column, the right kidney, the vena cava inferior, the aorta, and the right pillar of the diaphragm. By its whole inner side, it embraces the pancreas, from which it is separated below by the superior mesenteric vessels. Its outer side is immersed in the sub-peritoneal cellular tissue, between the right kidney and the ascending portion of the colon.

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* It is so named on account of its length being commonly estimated at twelve finger breadths.

2098. The *inner surface* of the duodenum is mucous like that of the stomach. There is seen upon it a multitude of circular folds, which differ extremely in their configuration, and are very close to each other. These are the *valvulæ conniventes.* They are formed by the mucous membrane alone, and their existence is constant in all states of the duodenum. They project three or four lines in its cavity. Some of them are oblique and cross each other, or run into those next them; their length is not the same in all; they never form entire circles, only representing arches which embrace the half, two-thirds or three-fourths of the intestine, whose pointed extremities advance unequally beyond each other. Their breadth varies as much as their length. The use assigned to them is that of retarding the progress of the alimentary substances for the purpose of favouring the absorption of the chyle. The reticular tissue which we pointed out at the inner surface of the stomach shows itself in the depth of the grooves by which they are separated.

2099. There is also observed in the interior of the duodenum, at the point of union of the second and third curves, a small tubercle, at the summit of which are seen the united or isolated orifices of the choledochus and pancreatic ducts.

2100. At its lower part the duodenum is continuous with the small intestine, without any very distinct line of demarcation being observed.

b. ORGANIZATION OF THE DUODENUM.

2101. From what we have just said, it has already been seen that the duodenum is not, like the stomach, invested with a serous membrane, the peritoneum being only applied upon it in a small portion of its extent. It is to this partial deficiency of the peritoneal coat that the intestine owes the faculty of dilating to such a degree as almost to equal the stomach in size.

2102. *Muscular Membrane* or *Coat.* It is pretty thick. All its fibres are transverse or circular, and have a great similarity to those of the stomach. The layer of dense and solid cellular tissue which unites it to the mucous membrane was called the *Nervous Coat* by the older anatomists.

2103. *Mucous Membrane* or *Coat.* It is reddish, very soft, spongy villous, and as if downy. It is of its replication that the valvulæ conniventes are formed. It possesses all the characters of the internal membrane of the stomach, and is truly continuous with it (2089). Between it and the preceding coat, there is observed a great quantity of flattened mucous follicles, the orifices of which are more visible than in the stomach.

2104. The arteries of the duodenum are very numerous, and come from the superior mesenteric, pyloric, pancreatic, and gastro-epiploic arteries. Its veins exactly correspond to the arteries. Its lacteals and lymphatics go to the ganglia situated above the pancreas. Its nerves come from the solar plexus (1844).

3. *Of the Small Intestine.*

a. CONFORMATION AND GENERAL DISPOSITION.

2105. The *Small Intestine (Intestinum tenue)*, in which the duodenum terminates, is the longest portion of the digestive canal. It forms a general great curve, of which the concavity is connected with the mesentery, while the convexity is free and floating, and it is moreover folded upon itself in different directions a great number of times, which produces turns to which the name of *Circumvolutions* is given.

2106. All these circumvolutions, of which the convexity is directed forwards, and whose concavity faces backwards towards the vertebral column, are placed close together, and constitute a considerable mass, which occupies, in the abdomen, the umbilical and hypogastric regions, and a portion of the lumbar and iliac regions, as well as of the excavation of the pelvis. This mass is circumscribed on all sides by the large intestine, that is to say, superiorly, by the transverse mesocolon, which separates it from the stomach, the pancreas, the liver and the spleen ; to the right, by the cœcum and ascending colon ; to the left, by the descending colon and the sigmoid flexure.

2107. The small intestine commences under the superior mesenteric vessels, on the left side of the transverse mesocolon, and terminates in the right iliac region, opening into the cœcum. There results from this that its general direction is inclined from above downwards and from left to right. Its length is great, being about four or five times the total length of the body. Many anatomists have divided it into two portions. Although they have failed to assign fixed and distinct limits to each of them. Of these two portions, the upper is named *Jejunum*, on account of its being commonly found empty ; the other is called *Ileon*. The jejunum occupies the two upper fifths of the small intestine, and the ileon the rest of its extent. It is easy enough to see that such a division is arbitrary and has no sufficient foundation.

2108. The small intestine has a much smaller calibre than that of the other parts of the digestive canal. It appears cylindrical when distended, but its transverse section is elliptical when it is empty. It is wider above than below. Its whole *outer surface* is perfectly smooth, excepting on its posterior edge, where it is destitute of peritoneum and lodged between the two laminæ of the mesentery. It is seldom that it presents fatty appendages, as are observed on the large intestines. Its *inner surface* has the same appearance as the duodenum (2098). There are seen upon it numerous villosities, disposed in the form of more or less prominent fringes, and extremely large valvulæ conniventes. But the latter are more numerous the nearer to the duodenum the intestine is examined, and diminish progressively towards the cœcum.

b. ORGANIZATION OF THE SMALL INTESTINE.

2109. *Serous Membrane* or *Coat*, and *Mesentery.** The peritoneum covers the entire surface of the small intestine, excepting at the level of the posterior edge, where it lies upon itself to be prolonged backwards by two laminæ which constitute the mesentery, and which leave between them and the intestine, at the moment of their coming together, a triangular space exactly similar to that which prevails along the curves of the stomach. In this space, the intestine does not adhere to the peritoneum, a circumstance which is singularly favourable to its dilatation.

With respect to the mesentery itself, it may be considered as a fold of the peritoneum which suspends and keeps in position the small intestine. One of its laminæ is continuous above with the transverse mesocolon; the other is attached below to the vertebral column, in the course of a line which descends from left to right, from the left side of the body of the second lumbar vertebra to the right iliac fossa. Narrow in the greater part of its extent, it is very broad anteriorly, near the intestine. It is evidently this inequality in the dimensions of the mesentery that is the cause of the existence of the circumvolutions of the small intestine; and it has been not inaptly compared to a semicircular piece of leather, having the larger edge drawn out and much elongated in opposite directions. This edge in fact corresponds to the whole length of the small intestine, while the posterior has no greater extent than that of the lumbar portion of the vertebral column.

The mesentery contains between the two laminæ of which it is formed, a great quantity of lymphatic ganglia, larger in children than in adults, and very irregularly disposed in a very thick layer of cellular tissue always loaded with fat. There are moreover observed in it the trunks and branches of the mesenteric vessels and the nervous plexus which accompany them, together with a great number of lacteal and lymphatic vessels.

2110. *Muscular Membrane* or *Coat.* It is not so thick as that of the duodenum, and its fibres are pale and not very apparent. The superficial fibres are longitudinal, very thin, not numerous, and collected especially along the convex edge of the intestine. They do not, however, by any means run along its whole extent, but are interrupted from space to space, and seem composed of shorter fibres whose extremities pass between each other. The deep fibres form a more distinct layer. They are curved in the transverse direction of the intestine; but none of them pass entirely round it, they being interrupted like the longitudinal.

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* Μέσος, *medius*; ἔντερον, *intestinum.*

The muscular membrane is connected with the peritoneum by a layer of cellular tissue, in general very thin, but pretty thick and loose on the side next the mesentery. It is separated from the mucous membrane by another layer of denser and more compact cellular tissue, which continues the *nervous coat* of the older writers, of which we have already spoken.

2111. *Mucous Membrane* or *Coat.* It is whitish and thicker than in the stomach. We have pointed out the valvulæ conniventes which it forms by being folded upon itself (2106). Its villosities, which are excessively numerous, and very apparent, are thin, flexible, and collected into pellets or fringes. On examining them with the microscope, it is discovered that each of them is terminated by an oval ampulla perforated with a small hole, which Lieberkuhn considers as the entrance of a lacteal vessel. The walls of this ampulla are lined with a very delicate and very dense net-work of arteries and veins. The intervals which exist between these villosities are furnished with a great number of mucous follicles, commonly designated by the name of *Peyer's Glands*, and which form slight prominences on the inside of the intestine. They are more numerous on the side next the mesentery than anywhere else. Their form is round or oval; there are also more of them in the lower region of the intestine.

2112. The arteries of the small intestine come from the convexity of the terminating branch of the superior mesenteric artery. Its veins join the vena portæ. Its lacteals, which are more numerous above than below, end in the ganglia of the mesentery. Its nerves arise from the superior mesenteric plexus (1859).

4. *Of the Large Intestine, or of the Cœcum and Colon.*

A.—OF THE CŒCUM.

a. CONFORMATION AND DISPOSITION.

2113. The *Cœcum* *, which is placed between the end of the small intestine and the commencement of the colon, in the right iliac fossa, which it almost entirely fills, has been so named because it dives inferiorly under the form of a cul-de-sac. Its volume is often triple that of the small intestine, and surpasses that of the colon or rectum. Its length is about three or four finger-breadths, and no other limits can be assigned it, to distinguish it from the colon than the termination of the small intestine. It has nearly the appearance of an irregular triangular prism. Its outer surface presents very large bulgings, irregularly disposed, and interrupted in three places by very distinct longitudinal depressions, formed by the union of the longitudinal muscular fibres. One of these depressions is anterior; the other two are posterior; but one is turned to the right and the other to the left.

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* *Intestinum cæcum,* the *blind intestine.*

The outer surface of the cœcum is in connection anteriorly with the walls of the abdomen, posteriorly with the psoas magnus and iliacus internus of the right side, internally with the small intestine, of which it receives the lower extremity, which is inserted into it so as to form an acute angle below and an obtuse or nearly right angle above. There is observed in this place a circular groove, deeper and more distinct below than above.

2114. The cœcum is surmounted by several appendages formed by particular folds of the peritoneum, and filled with fat. Their number, form, and size, are equally indeterminate below, to the left, and anteriorly. There is always seen arising from it, a particular appendage, of the same nature as itself, the *appendix vermiformis*, or *cœcal appendix*. It is of the size of a writing quill, varying from two to four inches in length, cylindrical, flexuous and bent upon itself; free nearly in its whole extent, but bound down to the right upon the cœcum by a fold of the peritoneum. Its surface is free, polished, whitish, and traversed by some vessels. It is hollow in its whole extent, and communicates with the cavity of the cœcum. Its walls are very thick, and it is constantly filled with a mucous fluid. In the fetus, the appendix vermiformis is remarkable for its great development. Its uses are entirely unknown.

2115. In its interior, the cœcum is lined by a mucous membrane, which we shall afterwards describe. It presents three longitudinal prominences, which correspond to the three external depressions mentioned above (2213), and cellules occupying their intervals, separated by transverse folds, and forming externally prominences which we have also mentioned. Inferiorly, and posteriorly, is seen the entrance of the appendix vermiformis, which is always free and open, and a little widened. To the left are the orifice of the small intestine and the *ileo-colic valve* or *valvule* of *Bauhin*. This valve, which is destined to prevent the return of the excrementitious matters from the cœcum into the small intestine, is elliptical, broad, soft, thick, without support, and directed transversely. In the direction of its great diameter it is divided by a slit which separates it into two lips united at their extremities, adhering to the intestine by their convex edge, and floating in its cavity by their concave edge. Of these two lips, the upper, which is narrower, corresponds above to the colon and below to the small intestine; while the lower, which is broader, faces the small intestine above, and the cœcum below. Their extremities unite and form a prominent line on each side, which terminates insensibly in the straight part of the cœcum. These rugæ were called by Morgagni the *Fræna of the Valvule of Bauhin.*

b. ORGANIZATION OF THE CŒCUM.

2116. *Serous Membrane* or *Coat.* The peritoneum wholly covers the inferior portion of the cœcum, and invests the greater part of it above. It then leaves it to pass upon the walls of the abdomen, without in general forming any fold. Sometimes, however, a more or less distinct fold is observed, to which the name of *Meso-cœcum* is given.

2117. *Muscular Membrane* or *Coat.* It is composed of longitudinal and circular fibres. The latter present nothing particular, and have exactly the same disposition as in the small intestine; but the longitudinal fibres are united into three distinct bands, and are shorter than the intestine itself, so that they oblige it to become puckered, shortened as it were, and to present the prominences of which we have already made mention (2113). These fasciculi seem to arise from the appendix vermiformis, and on cutting them transversely, the cœcum is immediately seen to elongate, and the transverse folds or prominences which it presented, entirely disappear.

The layer of cellular tissue which connects this membrane with the rest is thicker than in the small intestines, but in other respects presents nothing remarkable.

2118. *Mucous Membrane* or *Coat.* Its villosities are much less apparent than those of the small intestine. It has scarcely any valvulæ conniventes, and contains a greater quantity of mucous follicles; but they are isolated from each other.

2119. The *ileo-cœcal* valve is formed by the mucous coat of the small intestine and the cellular coat which lines it, folded upon itself, in such a manner as to project in the cœcum before being constituted by the same membranes of that intestine and of the colon. There results from this that it is formed of four mucous laminæ, two for each of its lips, and that in their interval there occurs cellular tissue. But moreover, there is observed in the lower lip, a layer of strong muscular fibres of a whitish colour, which are continuous with those of the small intestine.

2120. The appendix vermiformis is exactly similar to the rest of the cœcum in its structure; only its fleshy coat is very thick, and principally formed of longitudinal fibres. It is from it that the three bands of the intestine seem to come, as we have said.

B. OF THE COLON.*

a. CONFORMATION AND GENERAL DISPOSITION.

2121. The *Colon* forms the most considerable portion of the large intestine. It extends from the right iliac region to the left, between the cœcum and the rectum, with which it is continuous, and describing various turns which have caused it to be divided into four portions: 1. The *Right Lumbar* or *Ascending Colon*; 2. The *Arch of the Colon* or *Transverse Colon*; 3. The *Left Lumbar* or *Descending Colon*; 4. The *Sigmoid Flexure* or *Left Iliac Colon*.

2122. The *Ascending Colon* commences at the cœcum and ascends upwards and a little backwards to near the edge of the corresponding false ribs. *Anteriorly*, it is covered by the peritoneum and small intestine; *posteriorly*, it corresponds immediately to the quadratus lumborum and kidney of the right side; *internally*, it is connected with the inferior lamina of the transverse mesocolon and the right lamina of the mesentery (2109); *externally*, it is applied against the walls of the abdomen. Its volume does not much exceed that of the small intestine. Its mobility is not great, on account of its being connected with the kidneys and quadratus lumborum by a great quantity of adipose cellular tissue. Sometimes, however, the peritoneum forms for it posteriorly a more or less loose fold, which is named the *Right Lumbar Mesocolon*.

2123. The *Arch of the Colon* occupies the anterior and inferior region of the epigastrium, beneath the stomach, above the small intestine, behind the great omentum and before the transverse mesocolon. It commonly proceeds directly from one hypochondrium to the other; but sometimes also it is inflected in the middle and descends into the umbilical region. This is the longest and largest of the four portions of the colon. Its *upper surface* is free and smooth. It corresponds to the liver and the great curve of the stomach, which advances more or less upon it, and at its left end is in relation with the spleen. Its *lower surface*, which is also smooth and polished, rests upon the mass of the small intestine. Its *anterior edge*, which is convex, gives attachment to the great omentum, and is in contact with the walls of the abdomen; the *posterior* is concave, and embraced by a fold of the peritoneum named the *Transverse Mesocolon*.

2124. The *Descending Colon* commences under the spleen and bears the greatest similarity, in respect to size, fixedness, and relations, to the ascending portion. Like it, it is placed behind the small intestine, and before the left kidney and quadratus lumborum, with which it is connected by cellular tissue, or by a fold of the peritoneum named the *Left Lumbar Mesocolon.*

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* Κωλον of the Greeks, from Κωλύω, *perhibeo*.

2125. The *Sigmoid Flexure of the Colon*, which is of moderate size, very mobile, and in this respect similar to the small intestine, occupies the deeper part of the left iliac fossa, where it describes a double curve in the form of the letter S, whence its name. It commences at the end of the left lumbar region, and terminates at the upper strait of the pelvis, near the articulation of the last lumbar vertebra with the sacrum. It is surrounded in nearly its whole circumference by the peritoneum, which fixes it above and behind, by means of a very extended and very loose fold, directed obliquely from left to right, and named the *Iliac Mesocolon.* Anteriorly it corresponds to the small intestine; posteriorly, to the left psoas and iliacus muscles, as well as to the spermatic vessels and ureter of the same side.

2126. From the above simple account, it is easy to see that the colon describes in the abdomen a circle which measures nearly its whole circumference, and which contains the circumvolutions of the small intestine (2106). In its whole extent, the colon, like the cœcum, presents interrupted bulgings, produced by three longitudinal and depressed bands; but these prominences, which are not quite so large as in the cœcum, are almost entirely obliterated in the sigmoid flexure. It also presents a very great number of fatty appendages, owing to particular folds of the peritoneum, and so multiplied in its ascending and descending portions, that they seem to envelope it with a continuous layer. There are fewer upon the arch, and scarcely any upon the sigmoid flexure, where they are also much less voluminous.

2127. In its interior, the colon presents the same disposition as the cœcum.

b. ORGANIZATION OF THE COLON.

2128. *Serous Membrane* or *Coat.* It is formed by the peritoneum, which, after having enveloped the intestine, fixes it to the neighbouring parts by different folds, which take their name from the portion to which they belong. The largest of these folds is the *Transverse Mesocolon*, which proceeds from the concave edge of the arch of the colon which it supports, and forms a horizontal and moveable partition, which separates the epigastric region from the umbilical, and the stomach, liver and spleen, from the small intestine. It is broader at the middle than at its two extremities, and has a nearly semicircular form. It is composed of two laminæ, an inferior and a superior. The former is continuous with the mesentery (2109); the other is prolonged into the posterior cavity of the peritoneum, and covers a part of the duodenum. In the interval of these two laminæ are found the vessels and nerves destined for the arch of the colon, together with a great number of lymphatic ganglia. Between them and the concave edge of the intestine, there is observed an empty triangular space, similar to those which we have already described in the stomach and small intestine. These two laminæ, after uniting upon the colon, give rise to the anterior lamina of the great omentum.

The *Iliac Mesocolon* varies much with respect to its extent, and is similar to the other folds of the same kind. It is broader at the middle than at its extremities. It is continuous above with the descending mesocolon, or terminates in a point behind the colon, and inferiorly it is united to the meso-rectum. It also contains vessels, nerves, and some lymphatic ganglia.

2129. The *Muscular* and *Mucous Membranes* are absolutely the same in the colon as in the cœcum (2117).

2130. The arteries of the cœcum, of the ascending colon, and of half of the arch of the colon are furnished by the superior mesenteric artery. Those of the other parts of the colon come from the inferior mesenteric. The veins of these two intestines form the two meseraic veins and open into the vena portæ. The lacteals are less numerous on it than upon the small intestine. Its nerves are furnished by the two mesenteric plexus.

2131. The total length of the large intestine is about seven feet in a man of ordinary size. It forms about the fifth of that of the small intestine. The large intestine differs essentially from the small, in having a greater diameter, in having its longitudinal muscular fibres united into three bands, in the presence of a great number of adipose appendages, in its situation at the circumference and on the sides of the small intestine, in its mode of connection with the adjacent parts, and in the origin, number, and disposition of its vessels.

III.—*OF THE RECTUM, OR ORGAN OF DEFECATION.*

a. CONFORMATION AND GENERAL DISPOSITION.

2132. The *Rectum* occupies the posterior part of the pelvis, and terminates the digestive canal. It succeeds the sigmoid flexure of the colon, and extends from the left side of the sacro-vertebral articulation to the summit of the coccyx, where it opens externally. It is a little inclined from left to right at its commencement; but afterwards it follows the median line of the body nearly in a vertical direction, accommodating itself to the curve of the sacrum, and thus describing a curve, of which the general concavity is anterior. Frequently also it presents lateral inflections more or less distinct. It is cylindrical in the greater part of its extent; but, near its inferior extremity, it commonly presents a more or less considerable expansion. Less voluminous than the cœcum and colon, it is yet susceptible of very great dilatation, and does not present at its surface either rounded prominences or muscular bands; only in the state of vacuity, it is marked with some irregular transverse wrinkles, which arise from the falling in of its walls.

2133. The rectum being immoveably fixed in its place, its relations are not subject to variation, although they differ anteriorly in the different sexes. Thus in the male, it corresponds, inferiorly and anteriorly, to the fundus of the bladder, the prostate gland, and vesiculæ seminales, while in the female, it is covered by the vagina, with which it is connected by a very considerable vascular lace-work. To this union the name of *Recto-vaginal Septum* is given. But anteriorly and superiorly, the rectum is covered by the peritoneum in both sexes, and is in contact with the uterus in the female, and the body of the bladder in the male. Frequently, one or two convolutions of the small intestine glide between it and these organs.

Posteriorly, and in both sexes, the rectum lies upon the sacrum and coccyx, from which it is separated by the hypogastric vessels and nerves, contained in a fold of the peritoneum, broad above, where it is continuous with the sigmoid mesocolon, narrow below, and bearing the name of *Meso-rectum*. At its lowest part, it is in contact with the levator ani muscle. On its sides, this intestine is only connected with the adipose cellular tissue which occurs abundantly in the pelvis, and with the levatores ani.

2134. The *outer surface* of the rectum is smooth, polished, and white. Lined above by the peritoneum, it presents in its whole extent vertical and parallel striæ, which are owing to the presence of longitudinal muscular fibres uniformly diffused over its whole circumference, so that it has a considerable resemblance to the œsophagus considered also with reference to its exterior. There are, moreover, observed upon it, the numerous anastomoses of the hemorrhoidal vessels, and some fatty appendages towards the base of the sacrum.

2135. The *inner surface* of the rectum is commonly smooth in its upper half, but, in the lower, there are observed some parallel longitudinal wrinkles, which are thicker near the anus, and are of variable length. These wrinkles, whose number varies from four to ten or twelve, and which are called the *Columns of the Rectum*, are formed by the mucous membrane and the layer of subjacent cellular tissue. Between these columns, there are almost always to be found membranous semilunar folds, more or less numerous, oblique or transverse, of which the floating edge is directed from below upwards on the anterior side of the intestine. These folds form a kind of lacunæ of which the bottom is narrow and directed downwards. There are observed, moreover, on the inside of the rectum the orifices of mucous follicles which are directed from above downwards, and reddish villosities which belong to the mucous membrane. The follicles in question pour into the rectum a white and pretty thick mucus, so long as they are examined at some distance from the anus: but at the anus itself a hair is seen rising from their centre.

2136. The *upper extremity* of the rectum communicates with the end of the sigmoid flexure of the colon. The *lower*, which is very contracted, is terminated by a rounded and plicate orifice, to which the name of *Anus** is given. The anus is situated at about an inch before the coccyx. On its edges, the inner membrane of the intestine is continuous with the skin, which, there, is very delicate, furnished with radiating plicæ, and shaded with a greater or less quantity of hair which exists only in the adult male. This extremity is embraced by the sphincter ani (1092), and by the two levatores ani (1085).

b. ORGANIZATION OF THE RECTUM.

2137. *Serous Membrane* or *Coat.* The rectum is entirely destitute of this coat in its lower part, as we have just said. The case is very different with respect to its upper region, behind which the peritoneum even forms the fold named *Meso-rectum* (2133). When the uterus is greatly distended during gestation the peritoneum is raised up by that organ, and almost entirely leaves the rectum. In the male, the distention of the bladder causes the same phenomenon, but in a less degree.

2138. *Muscular Membrane* or *Coat.* It is thicker than in the other intestines, and has a great resemblance to that of the œsophagus. Its outer surface is separated above from the peritoneum by a layer of adipose cellular tissue. The inner is connected with the mucous membrane by a loose cellular tissue which is not adipose.

It is composed of two planes of fibres, the one superficial, the other deep. The superficial fibres, which are *longitudinal*, predominate in a decided manner in the two upper thirds of the rectum; the others, which are *circular*, exist in its upper third and near the anus. The former also have a white tint; the others acquire a reddish hue, which is so much the deeper the lower they are. This circumstance has induced many anatomists to describe around the lower part of the rectum a fleshy ring under the name of *Inner Sphincter of the Anus.*

2139. *Mucous Membrane* or *Coat.* It is similar to that of the rest of the digestive canal, only thicker, redder, more spongy, and covered with a thicker and more abundant mucosity. It presents the rugæ, lacunæ, and orifices of follicles of which we have already spoken. Its villosities are not numerous, nor has it any vulvula conniventes.

2140. No intestine receives so many blood-vessels as the rectum in proportion to its volume. Its arteries come from the inferior mesenteric, hypogastric and internal pudic arteries. They are collectively designated by the name of *Hæmorrhoidal Arteries*, and are distinguished into *superior*, *middle*, and *inferior.* Its veins go partly to the hypogastric, and partly to the inferior mesaraic. Its nerves come from the sciatic (1760) and hypogastric (1861) plexus.*

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* Πρωκτος of the Greeks.

CLASS SECOND.

ARTICLE SECOND.

ORGANS OF RESPIRATION.

I.—*OF THE LUNGS.*

a. CONFORMATION AND GENERAL DISPOSITION.

2141. The *Lungs (Pulmones)*† are two spongy, cellular, expansible organs, contained within the cavity of the thorax, separated from each other by the mediastina and the heart, surrounded by membranes which are named pleuræ, and destined to produce changes upon the air and blood which penetrate into them, on which is essentially founded the act of respiration.

Although the lungs are to appearance separate and distinct, they are yet vertically united to each other, since they receive the air by a single canal, and as the blood is transmitted to them by a single vessel. Their volume is not equal however, but on account of the projection of the diaphragm on the right side caused by the liver (821), and the obliquity of the mediastinum to the left, the right lung is thicker than the left, which in its turn has a greater vertical extent than it. The left lung is also a little smaller than the right. In all cases, the volume of the lungs is exactly proportioned to the capacity of the cavity of the thorax, being so much the larger the wider the latter is. They follow very accurately the motions impressed upon its walls, against which they are always applied, and dilate and contract like them; nor does any vacuity ever exist in the interior of the chest.

2142. The lungs are proportionally much lighter than the other organs; they never sink in water so long as they are in their natural state, and this lightness depends upon the air which penetrates their whole tissue. In infants which have never breathed, the lungs generally sink in the fluid in which they are immersed.

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* According to the physiological order, we ought to describe here the organs of absorption; but as their study is considerably facilitated by that of the organs of circulation, we shall defer their examination until we have described the latter.

† Πνευμονες of the Greeks.

But the absolute weight of the lungs varies much in the different individuals in which they are examined, which may depend upon the greater or less quantity of blood that remains in them at the moment of death, or upon a larger development. It is also to be observed, that in children which have not breathed, the lungs are, with respect to the total weight of the body, in the variable relation of 55, or 70 to 1; whereas the proportion is as 28, or 33 to 1, when respiration has taken place. The act of respiration, therefore, augments their gravity in a great degree, a circumstance which it is of importance to know with reference to medical jurisprudence.

2143. The colour of the lungs, in the healthy and adult state, is of a pale yellowish red, more or less approaching to white or gray. This tint is equally observed in the interior, and at the exterior of the organ. But if the blood happens to be too much accumulated in its parenchyma, the colour is a dark red or purple, uniformly diffused, or only dispersed in patches, which produces a marbled appearance. It is for this reason that the lungs are always more coloured on the side on which a dead body has lain. The reddish, or grayish colour of the lungs, is interrupted by small black and brown spots, irregularly dispersed at their surface, and more or less numerous. They are exactly defined, and in general affect a linear form. They are seldom isolated from each other. Some are entirely superficial, others penetrate more or less deeply into the tissue of the lungs, and there are some which seem limited to the pleura or membrane which immediately envelopes these organs, in the substance of which they also occur. Buisson considers them as analogous to the lymphatic ganglia of the bronchi. They only begin to make their appearance about the age of ten or twelve years.

2144. Of all the solid organs of the body, the lungs are those which have the smallest density. They may be compressed with the greatest ease, and only resume their original state imperfectly. Although flexible and soft, however, they have a tissue which is not easily torn.

2145. The form of the lungs is not very easy to be described. It may, however, in a general manner, be likened to that of a cone, having its base directed downwards, and its summit upwards, and flattened behind. The right lung is divided into three unequal lobes, by two oblique fissures; the left presents only a single fissure, and consequently has but two lobes.

Their *outer surface*, which is convex in its whole extent, especially behind, and nearly plain anteriorly, is free in its whole extent, and corresponds to the walls of the thorax, from which it is separated by the costal layer of the pleuræ. It is smooth and polished, and constantly bedewed with a serous fluid. On the left lung, it presents a fissure which descends obliquely from the posterior to the anterior edge, and divides the organ into two lobes, a superior and anterior, which is smaller, and a posterior and inferior, which is larger. This fissure nearly penetrates through the whole thickness of the organ. A similar fissure is observed on the right lung; but in it the upper lobe is divided into two portions by a secondary fissure running obliquely downwards and outwards, and consequently in a direction the reverse of the great fissure, and which varies much as to depth and extent. In the two lungs, the upper lobes, which are large above, terminate below in a point, while the contrary takes place in the lower lobes, which are always larger. In the right lung, the middle lobe is triangular, presenting its summit outwards, and its base inwards, and is smaller than the other two.

The *internal surface* of the lungs, which is plain or slightly concave, to accommodate itself to the shape of the heart, is in contact with the mediastinum, and corresponds behind to the vertebral column. About the middle of its height is seen the insertion of the bronchi and pulmonary vessels. Its two anterior thirds are in direct connection with the pericardium and thymus gland.

Their *anterior edge* is thin, sharp, especially below, oblique, sinuous, more or less uneven, directed obliquely downwards and forwards, and notched on the left side only, to receive the point of the heart.

Their *posterior edge* is thick, rounded, nearly vertical, and lodged in a groove which the ribs form on the sides of the vertebral column (103).

Their *base*, which is slightly concave, rests upon the upper surface of the diaphragm (875), and is inclined a little downwards, and outwards on each side. It is circumscribed by a sharp and sinuous edge, which is lodged between the ribs and the insertions of the diaphragm, and on which there occurs the end of the interlobular fissure.

Lastly, their *summit*, which is narrow, obtuse, and a little bulged, is situated at the level of the first rib, which it frequently surmounts a little.

b. ORGANIZATION OF THE LUNGS.

2146. The tissue of the lungs is very complicated. It seems essentially composed of prolongations and successive ramifications of the bronchi, and pulmonary arteries and veins, which stick together in all their divisions, and are sustained by a very fine cellular tissue, so as to constitute a series of lobules which are covered and united by the pleuræ, and interspersed with nerves, vessels, and lymphatic ganglia.

1. OF THE PLEURÆ.*

2147. The *Pleuræ* are two thin, diaphanous, perspirable membranes, which internally cover each side of the chest, and are reflected from thence over both lungs. Like all the serous membranes, to whose order they belong, their internal surface is always in contact with itself, and they thus represent each a bag without aperture. By their meeting together they form the mediastina, and their course is precisely the same on either side.

Proceeding from the sternum, the pleuræ direct themselves outwards, line the inner surface of the ribs, their cartilages and the muscles which occupy their intervals, separated, however, from the latter by the intercostal vessels and nerves, and by adipose cellular tissue. They thus advance as far as the vertebral column, reflected inferiorly over the diaphragm, of which they cover the thoracic surface, and superiorly under the upper ribs, behind which they form a kind of cul-de-sac for lodging the summits of the lungs. Towards the articulations of the ribs with the vertebræ, they are applied upon the thoracic nervous ganglia (1834) and their twigs, and then direct themselves over the lateral parts of the body of the vertebræ.

There the two pleuræ approach each other, although there remains between them a narrow and irregularly triangular space, in which are lodged the descending aorta, the œsophagus, the vena azygos, the thoracic duct, the lower part of the trachea, the commencement of the bronchi, and a great number of lymphatic ganglia, the whole immersed in a cellular tissue. This place is the *Posterior Mediastinum*, the direction of which is vertical and parallel to that of the vertebral column.

Anterior to this space, the pleuræ, which are very close to each other, do not yet come into contact, but pass to the sides of the pericardium, cover them at first over a small extent, and are reflected over the posterior part of the pulmonary vessels and over the lungs themselves. They cover at first the convex surface of the latter, their summit and base, diving deeply into the interlobular fissures. From thence they return upon their plain surface, the anterior part of the pulmonary vessels, and the other portion of the sides of the pericardium, at the fore part of which they again approach each other. They then gain the posterior surface of the sternum, and the point whence we have considered them as setting out, intercepting between them a space not parallel to the sternum, but inclined from above downwards and from right to left, broader below than above, very narrow at its middle part, and representing a kind of cross, of which the lower branches are more widely separated than the upper. This space, which is commonly named the *Anterior Mediastinum*, lodges the thymus gland above, and is filled below with adipose cellular tissue, which communicates with that of the abdomen through a separation of the fibres of the diaphragm, on the sides of the ensiform cartilage (872). On leaving the anterior part of the mediastinum, the pleuræ cover the internal mammary vessels and a certain number of lymphatic ganglia.

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* Πλευραι of the Greeks.

2148. The degree of adhesion which the pleuræ contract with the subjacent organs is not the same in their whole extent. They are easily detached from the sternum, ribs, intercostal muscles, and sides of the vertebral column, but are united in a more intimate manner to the surface of the lungs, although there exists between them and the parenchyma of the organ a kind of rather dense membrane, formed of cellular tissue. They are connected in a loose manner with the anterior and posterior part of the lateral surfaces of the pericardium, but on their middle region, and opposite the pulmonary vessels, they adhere with extreme firmness.

2149. The *inner surface* of the pleuræ is smooth, polished, moistened by a serous fluid, and free of all adhesion in the natural state; those which are frequently observed upon it being always the effect of some disease. By boiling, they lose their transparency, and acquire an opaque opaline tint. On the sides of the diaphragm, they present small adipose appendages, similar to those which we have described as occurring on the large intestine (2126), and they are a little thicker at the posterior surface of the chest than at the anterior.

2150. The arteries of the pleuræ come from the intercostal, internal mammary, diaphragmatic, inferior thyroid, thymic, pericardiac, and bronchial arteries. The veins exactly correspond to the arteries. A prodigious quantity of lymphatics is perceived in these membranes; but no nervous filaments have yet been traced in them.

2. OF THE AERIFEROUS CANALS OF THE LUNGS, OR THE TRACHEA AND BRONCHI.

a. GENERAL CONFORMATION.

2151. The *Trachea*, called also the *Trachea Arteria*, *Aspera Arteria*, or *Windpipe*, is a cylindrical, fibro-cartilaginous and membranous tube, a little flattened posteriorly, placed before the vertebral column, extending from the lower part of the larynx to opposite the second or third dorsal vertebra, in the posterior mediastinum. Running along the median line of the body, symmetrical and regular in its whole extent, slightly mobile and extensible, the trachea has a diameter of about eight or ten lines, which remains the same in its whole extent, varying only according to the age and certain individual peculiarities. It is in general proportional to the size of the lungs.

2152. The *anterior side* of the trachea is convex, and is covered above by the thyroid gland, inferior thyroid veins, and sterno-hyoidei and sterno-thyroidei muscles, from which it is separated by a layer of pretty thick loose cellular tissue. Inferiorly, it corresponds to the thymus gland, the left sub-clavian vein, the brachio-cephalic artery, and the arch of the aorta. Its *posterior side*, which is flattened, covers the œsophagus, and a little to the right of the bodies of the vertebræ, which arises from the obliquity of the œsophagus (2065). *Laterally*, it approaches the common carotid arteries, the internal jugular veins, the pneumo-gastric nerves, and the communicating twigs of the cervical ganglia, which are separated from it by a mass of adipose cellular tissue.

2153. At its inferior extremity, the trachea bifurcates, and gives rise to two canals which penetrate into the lungs. These are the *Bronchi*, which are distinguished into right and left, and which separate from each other, directing themselves downwards and outwards, at nearly a right angle. The *Right Bronchus* is larger, shorter, and more horizontal than the left, and is a little anterior to it. It penetrates into the lung opposite the fourth dorsal vertebra, is embraced in its course by the curve of the vena azygos, and by the arch which the right branch of the pulmonary artery forms. The left *Bronchus*, which is a little smaller, but longer and more oblique, is embraced by the arch and left branch of the pulmonary artery.

Arrived in the lungs through the medium of their internal surface, the bronchi divide into two branches, which, after a very short course, bifurcate themselves, and thus give out branches becoming gradually smaller, which take all kinds of directions, and present the same appearance as the arteries. These ramifications seem to divide the whole tissue of the organ into lobules separated from each other by cellular tissue, and absolutely exist in all points. It is extremely difficult to trace them to their termination. Malpighi thought that they end by rounded and membranous vesicles which, according to Willis, are pedicellate. Senac imagines the lobules of the lungs to be composed of polyhedral vesicles, the sixth of a line in diameter, into each of which a twig of the bronchi opens. But it appears demonstrated, on the contrary, that the bronchi, ramified to infinity, ultimately terminate by a small undilated cul-de-sac, and that it is from the union of several of these minute twigs, kept together by the cellular tissue in which they are immersed, that what is called the *Pulmonary Lobule* results.

b. ORGANIZATION OF THE TRACHEA AND BRONCHI.

2154. The aeriferous canals of the lungs are composed of fibro-cartilaginous rings, membranes, arterial and venous vessels, lymphatics, nerves, mucous follicles, and bodies of a peculiar nature known by the name of *Bronchial Ganglia* or *Glands*.

2155. *Fibro-cartilaginous Rings.* There are from sixteen to twenty of these rings in the trachea. They are not complete, however, being interrupted in their posterior third. They are placed horizontally above each other, and separated by narrow membranous intervals. Curved upon themselves, and flattened in the plane of their direction, they have all the same length, but they vary much as to breadth. Their form approaches that of a very elongated right-angled triangle, when they are stretched out. They are commonly thicker at their middle part than at the extremities, which are sometimes bifurcated. By their convex surface, they correspond to a fibrous membrane, and by the concave are in connection with a mucous membrane. Their rounded edges give attachment to the first of these membranes, and project a little more on the inner than on the outer surface of the canal. Sometimes also several of them are seen to unite and be confounded with each other. The first is commonly very broad, and sometimes joins the cricoid cartilage. The last is still broader, and is very different from the others. It is triangular, and its middle part is prolonged inferiorly, bending a little backwards, to accommodate itself to the origin of the bronchi.

In the first ramification of the bronchi, the fibro-cartilaginous rings are entirely similar to those of the trachea, only thinner, smaller, and sometimes formed of several pieces. But in the secondary ramifications they are merely small irregular sheaths, varying in form, united or separate, which gradually diminish, so as to disappear entirely in the ultimate divisions of these canals.

The colour and consistence of the fibro-cartilage of the trachea and bronchi are the same as in those of the ear, the apertures of the nose, &c. Their elasticity is very remarkable. They seldom ossify, even in the most advanced old age.

2156. *Fibrous* or *Outer Membrane.* It comes from the inferior circumference of the cricoid cartilage, and is prolonged to the last extremities of the bronchi, becoming gradually thinner to an excessive degree. It is formed of longitudinal and parallel fibres, of which the more superficial are reddish, the deeper white.

This membrane alone forms posteriorly the solid portion of the trachea, which gives that canal a rounded form in this place. Anteriorly it is continually interrupted by the fibro-cartilaginous rings which appear developed in its substance, and it only sends before them a very small number of fibres.

The *outer surface* of this membrane is sprinkled posteriorly with reddish, oval, or rounded granulations, varying in their figure. These are mucous follicles, the excretory ducts of which traverse the whole substance of the canal to open upon its inner surface. They are commonly named the *Glands of the Trachea.* They are wanting anteriorly.

Its *inner surface* corresponds anteriorly, and, in the intervals of the fibro-cartilages, to the mucous membrane, from which it is separated by a multitude of other smaller granulations, varying in colour, which also appear to be follicles. But posteriorly, it is immediately applied upon a layer of transverse fibres, very close and dense, attached to the extremities of the rings, and of a muscular nature. These fibres are disposed in small bundles, and form a perfectly distinct plane.

2157. *Mucous* or *Inner Membrane.* This is a continuation of the membrane of the larynx (1408), and extends to the termination of the bronchi. Thin, reddish, and plicate in the direction of its length, especially at the back part, where it is applied against the fibres of muscular appearance of which we have just made mention, it corresponds in the rest of its extent, to the inner surface of the fibro-cartilaginous rings, and, between them, to the fibrous membrane. It has in general little adhesion to these different parts. Its inner surface is perforated by the excretory orifices of its mucous follicles, which constantly pour out a rather thick and not very plentiful fluid. Its organization presents nothing remarkable.

2158. The vessels of the trachea come from the superior and inferior thyroid. Its nerves are furnished by the pneumo-gastric nerve, (1638, 1639) and cervical ganglia (1815, 1824). The bronchi have arteries which bear their name, and which arise immediately from the aorta. They are commonly two in number, a right and a left. They have corresponding veins, which empty their contents, to the right into the vena azygos, and to the left into the superior intercostal vein. Their nerves are supplied by the two pulmonary plexus (1640, 1830, 1837).

2159. *Lymphatic Ganglia of the Bronchi* or *Bronchial Glands.* They are very numerous, and are situated before the bifurcation of the trachea, around the bronchi, and even in the interior of the lungs, where they are irregularly disseminated. Their form presents numerous variations, being sometimes oval, or rounded, sometimes lobular, &c. They also vary much as to size. The larger are lodged above the trachea, the smaller in the intervals of the bronchi. Their colour is black, or of a dark brown in the adult, reddish in children. Their tissue has in general little consistence. They are crushed under the fingers, to which they communicate their colour. I have never been able to discover the excretory ducts which some anatomists give them, and by which they are supposed to pour out a peculiar fluid into the bronchi, but I have distinctly seen several times, as Haller states, lymphatic vessels going to them, or issuing from them to throw themselves into the thoracic duct. Fourcroy thought their black colour owing to the accumulation of the charcoal which he supposed to be separated from the blood during the act of respiration.

3. OF THE PROPER TISSUE OF THE LUNGS.

2160. We have already, to a certain degree, an idea of the intimate structure of the lung, as we know several of the organs which enter into its composition. But when we come to consider it with some attention, without reference to its constituent parts, we find that it is divided into several lobules, distinct even at the exterior, and separated from each other by small whitish grooves. They are especially very well seen on tearing the tissue of the organ after submitting it to boiling. They vary much as to volume and form. They present, in general, a number of small surfaces, bounded by prominent angles, and present in their intervals a loose, filamentous cellular tissue, destitute of fat, very extensible, and capable of becoming emphysematous with the greatest ease, whether during life, by the rupture of a division of the bronchus, or after death, by insufflation. Each of these lobules is divided into smaller, without its being possible to discover the precise termination of this division. The intimate structure of these last lobules is unknown. Willis asserted that they have a racemiform arrangement around the ramifications of the bronchi, which, however, does not appear to be the case. It is only very probable that they are formed by the union of the last extremities of the bronchi, vessels and nerves which are distributed in the lungs.

2161. Besides the parts which we have already seen to enter into the composition of the lungs, there also occur the pulmonary arteries and veins, of which we shall speak when we come to treat of the heart. They in fact establish an intimate connection between the organs of respiration and those of circulation.

II.—*OF THE THYMUS GLAND.**

2162. This name is given to an organ, the uses of which are entirely unknown, but which, on account of its position in the anterior mediastinum, naturally comes to be examined after the organs of respiration. It is parenchymatous, bilobate, *glandiform*, oblong, soft, lobular, and of very variable colour and size. It is to be observed that in the fetus it extends nearly from the thyroid gland to the vicinity of the diaphragm, and progressively diminishes with age, so that in the adult it is, as it were, in a state of atrophy, and in old persons can only be discovered with difficulty in the midst of the cellular tissue.

2163. The thymus gland occupies the upper separation of the anterior mediastinum, and corresponds posteriorly to the trachea (2152), the inferior thyroid veins, the left subclavian vein, the vena cava superior, the arch of the aorta, and the pericardium. Anteriorly, it is covered by the upper part of the sternum and by the lower part of the sterno-thyroidei muscles. Its edges are in contact with the pleuræ below. Its upper extremity is divided by a notch into two portions, of which the right is generally thicker and longer than the left. Its inferior extremity, which is longer, is also notched, and presents the same relation between its two portions. These two notches are continued into each other by a groove which prevails along the anterior surface of the thymus gland.

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* Θυμος of the Greeks.

2164. This organ is enveloped by a very thin globular capsule, which sends prolongations into its interior, and thus divides its soft yellowish or whitish parenchyma into lobules of unequal size, in each of which there are distinguished several vesicles filled with a milky and slightly viscous fluid, and appearing to communicate with each other in the whole extent of the organ. No excretory duct has been discovered for it, but it is traversed by blood-vessels and lymphatics. Its arteries, although of a small size, are pretty numerous. They arise from the inferior thyroid, internal mammary, bronchial, mediastinal and pericardiac arteries. The veins precisely correspond to the arteries. It receives some nervous filaments from the pneumo-gastric and diaphragmatic (1667) nerves, and from the inferior cervical ganglia.

CLASS SECOND.

ARTICLE THIRD.

ORGANS OF CIRCULATION.

I.—*OF THE HEART AND ITS ENVELOPES, OR OF THE CENTRAL ORGAN OF CIRCULATION.*

OF THE PERICARDIUM.*

2165. The *Pericardium* is a membranous bag which envelopes the heart and the arterial and venous trunks which issue from or enter into it. It is lodged in the inferior separation of the anterior mediastinum, above the central aponeurosis of the diaphragm, to which it is strongly united. Its form is, at first sight, that of a cone, with the base directed downwards and a little to the left; but when freed of the fat in which it is, as it were, immersed, and extricated from the laminæ of the mediastinum, it is found to be exactly moulded upon the heart. Its size is proportioned to the volume of the organ which it incloses.

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* Περί, *circa*; Καρδία, *cor*.

2166. *Anteriorly*, the pericardium is covered by the pleura, excepting in its middle part, where it corresponds to the separation of the mediastinum and to the thymus gland, and by intervention to the sternum and cartilages of the last true ribs of the left side, from which it is separated laterally by the fore part of the lungs. *Posteriorly*, it is of very small extent, and rests upon the bronchi, œsophagus, and descending aorta. *To the right and left*, it is in connection with the pleuræ, the phrenic nerves (1667), and the internal surface of the lungs. *Inferiorly*, it corresponds to the aponeurotic centre, and a little to the left, to the fleshy fibres of the diaphragm.

2167. The pericardium is composed of two membranes, an outer and fibrous, and an inner and serous.

2168. *Fibrous Membrane.* Intimately united below with the aponeurosis of the diaphragm, it ascends around the heart, which it embraces as far as its base, and there is continued to a greater or less distance upon the great trunks of the vessels, dividing into several distinct sheaths which accompany them to a certain distance. The pericardium, therefore, is not perforated to allow these vessels to pass, as many anatomists have alleged; but its fibrous lamina loses itself insensibly on their walls, and even seems to be thus united with them. These sheaths are eight in number: one, which is very short, for the vena cava superior; four, still shorter, for the pulmonary veins; one, which is indefinitely prolonged, for the aorta; two for each pulmonary artery. The vena cava inferior penetrates into the pericardium through the centre of the diaphragm, and has no fibrous sheath.

This fibrous membrane corresponds directly to the pleuræ by the greater part of its outer surface. It is separated from them by a layer of more or less thick adipose tissue, excepting in its middle, where the contact and adhesion are more intimate. Its inner surface is lined in nearly its whole extent by the serous membrane, excepting when it is continued upon the vessels.

2169. This membrane presents the greatest resemblance to the dura mater in its structure, only it is not so thick. Its colour is pearly and aponeurotic. It fibres are sometimes isolated, often brought together in distinct bundles, of variable thickness and breadth, irregularly disposed, and crossing each other in all directions. The greater number, however, ascend vertically and parallel to the axis of the pericardium, being continuous below with the phrenic aponeurosis, and separating above upon the vessels.

2170. *Serous Membrane.* It has a much more extended course than the fibrous membrane, as, after lining its inner surface, it is reflected over the heart and covers it entirely, without, however, containing it in its interior, in which respect it is similar to the other serous membranes which we have already examined, as the arachnoid membrane and the pleuræ. Applied below, directly and in a very close manner, upon the aponeurosis of the diaphragm, it ascends forwards along the fibrous membrane to the place where the latter is prolonged upon the great vessels of the base of the heart. There, it is reflected at the middle upon the aorta, above its first curve; to the left upon the pulmonary artery, before its bifurcation, to the right upon the vena cava superior, about an inch above its entrance into the auricle, and on the right pulmonary veins, immediately after their issuing from the lung. It covers the anterior surface of all these vessels, penetrates into their intervals to a greater or less distance, and invests the aorta and pulmonary artery in their whole circumference, excepting in the place where they are in immediate contact. It also covers, between them, the ductus arteriosus, or the ligament by which it is substituted. In the place where this membrane is reflected, the separation of the two laminæ of the pericardium may be very distinctly seen, a very perceptible triangular space existing between them.

Having thus arived at the base of the heart, the serous membrane of the pericardium proceeds directly from the pulmonary artery over the ventricles, and from the vena cava over the righ auricle. On leaving the aorta, it is prolonged into a depression which exists between that artery and the right auricle, whence it also directs itself towards the ventricles. From the summit and edges of the heart, it goes to the posterior surface of that organ covers it, ascends again to its base, embraces to the right and below the vena cava inferior, to the left and above the left pulmonary veins, and is reflected over the posterior part of the fibrous membrane.

This membrane dives into all the irregularities which the hear presents at its surface, where it is so thin and transparent, especially upon the ventricles, that it becomes very difficult to demonstrate its existence, excepting in the places where it is separated from the fleshy fibres by adipose cellular tissue. It adheres intimately to the fibrous membrane, and can only be detached from it in points of small extent, or at the place of its reflection. It ha very little attachment to the vessels, and can easily be raised from their surface.

2171. The inner surface of this membrane, which is everywher in contact with itself, is continually moistened by a serous fluid It is smooth and polished.

2172. The arteries of the pericardium are very small, and aris from the thymic, phrenic, bronchial, and œsophageal arteries, th coronary arteries of the heart, the internal mammary arteries an the aorta itself. Its veins correspond to the arteries, and partl terminate in the vena azygos. Its lymphatic vessels go to th ganglia which surround the vena cava superior and the origin o the aorta. Nervous filaments have not yet been traced into th substance of its laminæ.

2. OF THE HEART.*

a. GENERAL CONFORMATION.

2173. The *Heart (Cor)*, the centre of the circulation, is a hollow muscular organ, of an irregular conical or pyramidal form, inclined forwards, downwards, outwards and from right to left, flattened posteriorly and inferiorly, and lodged in the pericardium. We have already pointed out its general relations in describing the latter organ.

Its volume varies much in different individuals. Its mass, compared with that of the body, is very small; but, in general, it is so much the greater the younger the subject is. Although it is retained by the pericardium, the mediastinum and large vessels, its situation changes every moment during life, because it follows the motions of the diaphragm, or because its weight drags it in different directions, according to the position that is assumed.

2174. Its *anterior surface*, which is turned a little upwards, is convex, and presents, in its middle, a groove which traverses it obliquely from above downwards, and from left to right, and in which are lodged the anterior coronary artery and vein, in the midst of a considerable quantity of adipose tissue. The portion of this surface which is situated to the right of the groove, is much broader than that to the left.

2175. Its *posterior surface* is directed downwards, and is nearly horizontal. It is flat, and rests upon the aponeurotic centre of the diaphragm, from which it is separated only by the serous membrane of the pericardium. It is traversed nearly vertically by a groove which receives the posterior coronary artery and vein, and which joins the preceding at the apex of the heart. The portion of the posterior surface of the heart which is to the left of the groove is much broader than that which occupies its right side.

2176. The *right side* of the heart is at the same time inferior. It is thin, coming to an edge, longer than the left, and resting upon the diaphragm. The *left side* is directed backwards and upwards. It is obtuse, rounded, very thick, and coasted by the posterior coronary artery.

2177. The *base of the heart*, which is situated above, behind, and to the right, slightly inclined from above downwards, and from left to right, is separated from the vertebral column by the aorta and œsophagus, and is connected with the pericardium through the medium of arteries which issue from it, and of veins which go to it. There is observed upon it an oblique groove, which indicates the junction of the auricles and ventricles. The *summit*, which ooks forwards, downwards, and to the left, is lodged in a notch of the lung of that side (2145), corresponds to the interval of the cartilages of the fifth and sixth ribs, is furnished with much fat, and presents a depression which marks the point of union of the two grooves, of which we made mention in describing its surfaces.

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* Κῆρ, Καρδια of the Greeks.

2178. The heart contains four cavities, which are named its *ventricles* and *auricles*. The two auricles occupy its base, or its superior and posterior region. The two ventricles are contained in its inferior part. An auricle and a ventricle are placed to the right, and to the left the same disposition is observed. On each side, the auricle communicates with the corresponding ventricle; but the right cavities never communicate directly with the left in the natural state and after birth. In the right cavities there is found black blood, which is to be incessantly submitted to the action of the air in the lungs. In the left, there is found red blood, which has already undergone this action. The former receive the blood from all parts of the body, and drive it into the lungs; the latter receive the blood from the lungs, and drive it through the whole body. It is from this important consideration that in our days there are pretty generally distinguished two principal parts in the heart, the one right and the other left.

b. RIGHT PART OF THE HEART.

RIGHT AURICLE.

2179. The *right* or *anterior auricle* occupies the inferior, right, and anterior part of the base of the heart, and rests upon the diaphragm. Its form is very irregular and difficult to be described. Transversely elongated, it presents its greatest breadth to the right and behind, its narrowest part before and to the left, in which latter direction it is prolonged by a flattened loose appendage, terminating in a point, irregularly dentated on its edges, and placed transversely between the aorta and the right ventricle. It is in general wider than the left auricle.

2180. Its *outer surface* is free externally; but internally it is united with the left auricle, below with the right ventricle, behind with the orifices of the two venæ cavæ. Anteriorly, it is surmounted by the appendage mentioned above.

2181. Its *inner surface* presents four sides for examination. 1. Its *posterior side* presents at its upper part the orifice of the vena cava superior, directed obliquely forwards and downwards, and furnished with a rounded, thick, and fleshy projecting edge, more distinct and stronger posteriorly, and which is directed obliquely upwards and inwards. These two apertures are very close to each other, and are even continuous by a portion of their circumference. In this common portion there is sometimes observed a more or less distinct tubercle, to which the name of *Tuberculum Loweri* has been given, and which is nothing else than a prominence formed by fat or by a fleshy bundle.

Inferiorly, the orifice of the vena cava inferior is furnished with a membranous replication which advances into the cavity of the auricle, and is named the *Eustachian Valve.* The breadth of this valve varies much in the adult, but it can never entirely close the aperture of the vein. Its dimensions are more considerable in children, and especially in fœtuses, and it becomes gradually obliterated with age, so as to be very indistinct in old persons. Its position is nearly vertical, and its form semilunar. Its *posterior surface*, which is directed backwards, to the right and upwards, corresponds to the cavity of the vena cava inferior. The *anterior*, which has an opposite direction, corresponds to the cavity of the auricle. Its *free edge*, which looks upwards and backwards, is sometimes reticular. It is more or less concave, but is always very thin. Its *right extremity* is connected with the circumference of the vena cava inferior, while the *left* is prolonged upon the inner wall of the auricle, and is continuous with the anterior pillar of the fossa ovalis, of which we shall presently speak.

Under the Eustachian valve, and above the entrance of the ventricle, is the common aperture of the coronary veins, which is also furnished with a semilunar valve, but broad enough to close it entirely, and of which the free edge is directed downwards.

2. Its *anterior side* presents at its upper part the small cavity of the appendage, remarkable for the prominences which are formed in it by a multitude of fleshy columns crossing each other, and inferiorly, the wide aperture by which the two right cavities of the heart communicate. This aperture is circular when the heart is full, elliptical when it is empty, and is margined with a kind of white zone, of which we shall subsequently speak. It is called the *Right auriculo-venticular opening.*

3. The *outer side* presents nothing remarkable but a great number of irregular prominences, formed by muscular bundles which leave between them spaces of various dimensions, and of which the principal are in general directed from behind forwards. These prominences are commonly less numerous than in the appendage.

4. Its *inner side* is formed by a septum which separates the right auricle from the left. In the adult it presents under its middle part a depression which is named the *fossa ovalis*, and which is more distinct above than below, where it disappears insensibly, becoming continuous with the vena cava inferior. The surface of this depression is sometimes smooth, sometimes uneven and reticulated. It does not appear to have any fixed limit behind; but, anteriorly, it presents a kind of very thick semilunar valve, of which the inferior extremity is continuous with the Eustachian valve. By its inner surface, this valve corresponds to another valve which projects in the left auricle, and which forms of itself the bottom of the fossa ovalis. On pushing from behind forwards the handle of a scalpel between these two valves, a passage is easily obtained from the right auricle into the left.

The space occupied in the adult by the fossa ovalis is occupied in the fetus by an aperture which is named the *foramen ovale*

(Foramen of Botal), and which sometimes remains open after birth. Its use is to transmit, before the period of birth, the blood of the vena cava inferior directly into the left auricle.

2182. There are observed moreover in the whole extent of the inner surface of the right auricle a great number of small orifices not furnished with valves. They belong to the veins of the walls of the heart.

RIGHT OR ANTERIOR VENTRICLE.

2183. Wider and broader, but less extended in length than the left, at the right and anterior part of which it is situated, the right ventricle has a considerable resemblance to a triangular pyramid, of which the base is turned upwards and backwards, and is confounded with the corresponding auricle. It has more extent on the anterior surface of the heart than on the posterior.

2184. Its *anterior and outer wall* is rather thin and very concave. The *posterior and inner* is formed by a septum, which equally belongs to the left ventricle, and constitutes a semi-ovoidal projection. Their thickness is unequal in the different parts of their extent. Both are pretty smooth towards their base; but, in the rest of their extent, they present a great number of muscular bundles, commonly designated by the name of *Columnæ carneæ*, and which vary much as to size, length, and direction. Their disposition is in general rather irregular, some directing themselves vertically from the summit to the base, while the others cross them in all sorts of directions, and form with them a very confused network.

Of these columns some are much larger than the others. Their number varies from three or four to eight or nine. They are rounded, and differ so much in length, that there are some of them which resemble mere tubercles, while others have an extent o nearly an inch. All arise from some point of the walls of the ventricle, direct themselves, becoming larger, from its summit to wards its base, and terminate abruptly, each by several small ten dons, *(cordæ tendineæ)* which are inserted into the points of th tricuspid valve, diverging sensibly from each other, and sometimes anastomosing, as it were, with each other. Some of these tendon are bifurcated, and most of them are enlarged at the moment their termination.

Other fleshy columns of the right ventricle, more numerous tha the preceding, are attached to its walls by their two extremitie but are free in their circumference.

Others again are attached to the walls in their whole extent, ar in the manner of pilasters. These are the most numerous and th thinnest. They follow all kinds of directions, and are interlace with each other, so as to represent net-work, leaving between the depressions, differing in form and dimensions.

2185. The *base* of the right ventricle is perforated by two ape tures.

One of these, the *Right Auriculo-ventricular Orifice*, which is situated posteriorly, is broader, and separated from the other by an interval of about an inch, communicates with the auricle, and is furnished with a membranous fold, named the *Triglochin* or *Tricuspid valve*, on account of its being commonly divided into three triangular portions. One of the surfaces of this valve is turned towards the walls of the ventricle, and the other on the side next the cavity of the auricle. Its adherent edge is attached to the circumference of the orifice, and surrounds it without interruption. Its free and mobile edge is connected with the cordæ tendineæ or tendons of the columnæ carneæ. It is very irregular, and presents variable intersections, among which, however, there are always remarked two or three of larger size than the rest. One of these, which is triangular, longer and broader than the others, and directed from above downwards, exactly closes, when it is laid down, the entrance of the pulmonary artery. This valve, which is thin and transparent in its whole extent, becomes decidedly thicker at its free edge, for the attachment of the small tendons, of which we have spoken.

The other aperture of the base of the ventricle, is of smaller size than the preceding, and leads to the pulmonary artery.

C. PULMONARY ARTERY.

2186. This artery, which is destined to carry into the lungs the blood which is to be submitted to the action of respiration, arises therefore from the upper and left part of the right ventricle, within which its orifice is surrounded by a callous ring, which indicates the limit of the fleshy fibres of the heart. But, externally, these fibres ascend upon the artery, over an extent of about half a line. This orifice is moreover furnished internally with three membranous folds, which are named *Sigmoid* or *Semilunar Valves*. They have the form of a crescent when they are applied against the walls of the vessel; but, when laid down, they resemble those baskets in which pigeons are hatched. Adhering to the artery by their whole convex and inferior surface, they present above a free, horizontal, and straight edge, on the middle of which is placed a small prominent tubercle, of a fibro-cartilaginous consistence. They are in contact at their extremities, and are thin and transparent. When let down, they completely close the artery, and prevent the blood which it contains from entering into the ventricle.

2187. Immediately after its commencement, the pulmonary artery directs itself obliquely upwards and to the left, crossing the course of the aorta, to which it is united by an abundant adipose cellular tissue. It is placed at its left side, and at the end of a course of two inches, at the height of the second dorsal vertebra, it divides into two trunks, one for each lung. These trunks separate from each other almost transversely, and circumscribe between them and the bronchi, which are above, an irregular rhomboidal space. In their interval, there is seen rising, in the adult, a kind of pretty thick, rounded ligament, seeming to follow the course of the artery itself, and passing from its walls to the concave part of the arch of the aorta. In the fœtus, this ligament is a true vessel, which is named the *Ductus arteriosus*, and which transmits to the aorta the blood of the right ventricle of the heart.

2188. The right pulmonary trunk, which is longer and less voluminous than the left, passes transversely behind the aorta and vena cava superior, forms an arch which embraces anteriorly the corresponding bronchus (2153) ; gains the lung, and divides into three principal branches.

2189. The left pulmonary trunk passes obliquely before the aorta and above its arch, embraces the bronchus of its side, and divides into two branches only, one for each lobe of the lung.

2190. Once entered into the lungs, the first divisions and the successive ramifications of the pulmonary artery accompany the bronchi to their last extremities, multiplying like them, so that there is no part of the organ however small which does not receive twigs from them. At their termination these minute twigs anastomose with the roots of the pulmonary veins, and with the bronchial arteries and veins.

2191. The pulmonary artery has the same structure as the aorta, of which we shall speak as we proceed; only its walls are much weaker, and are observed to be collapsed in the state of vacuity.

d. PULMONARY VEINS.

2192. They arise from the last extremities of the pulmonary arteries, and are collected into small twigs and branches, becoming successively larger, which never leave the divisions of the bronchi, and proceed along with those of the arteries. Only it is observed that in general the venous twig is placed beneath, and the arterial above the bronchial twig. At length all the pulmonary branches and veins unite into four trunks which leave each lung, two and two, at the middle of its internal surface, and penetrate into the pericardium.

The *Superior Right Pulmonary Vein* emerges under the bronchus, directs itself obliquely downwards, and opens into the upper part and to the right of the left auricle of the heart. The *Inferior* comes from the lower lobe of the lung, and ascends obliquely towards the inferior right part of the same auricle. They are both difficult to be exposed, being concealed by the vena cava superior and the neighbouring part of the right auricle.

The two *Left Pulmonary Veins* follow the same course, and are merely a little nearer each other.

2193. The pulmonary veins have the same structure as the other veins of the body, from which they differ in the circumstance that during life they contain red blood. It is by them that the blood is carried to the left cavities of the heart, after its elaboration in the lungs.

e. LEFT PART OF THE HEART.

LEFT AURICLE.

2194. Situated at the upper, posterior and left part of the heart, the *Left Auricle* is almost entirely concealed by the great vessels of the base of that organ, so that, at first sight, there is nothing perceived but its appendage, near the left side of the pulmonary artery. Its form is somewhat cubical, while that of the right auricle may be in some measure compared to a segment of an ovoid. Its capacity is about a fifth less than that of the latter.

Posteriorly, it rests upon the vertebral column from which it is separated by the pericardium. Anteriorly and internally, it is united to the rest of the heart. From its inner and upper part there is seen rising an appendage similar to that of the right auricle (2179), but smaller and directed to the right. Its edges are equally jagged, but its form is triangular.

2195. Its *inner surface* presents four walls or sides for examination:—

1. The *posterior side* is smooth and presents nothing remarkable below. Above, it receives the right pulmonary veins.
2. The *anterior* presents below a wide aperture which leads into the left ventricle, and above the cavity of the appendage, which contains much fewer musculi pectinati than that of the right appendage (2181).
3. The *right* is smooth and formed by the inter-auricular septum (2181). There is observed upon it a semilunar valve which presents its concave edge anteriorly and to the left, and which forms the bottom of the fossa ovalis, of which we have spoken.
4. The *left* is perforated by the two corresponding pulmonary veins, the orifices of which are very near each other, and even seem to be confounded. Like those of the right pulmonary veins, they are destitute of valves.

LEFT VENTRICLE.

2196. It occupies the posterior and left part of the heart. It is a little narrower, but longer than the right, and advances more upon the summit of the organ. Its form is that of a pyramid a little flattened; but, as its walls are very thick, it never presents the same falling in as the opposite ventricle. At its exterior, it presents nothing remarkable, only that the fat is less abundant there than on the right side.

In the interior, it presents columnæ carneæ similar to those of the right ventricle (2184), but less numerous and more irregularly disposed. Two of these fleshy bundles, which are larger than the others, and free at their circumference, arise the one before, the other behind, and a little beneath the middle part of the wall of the ventricle, by several distinct and smaller bundles, ascend obliquely towards the base of the heart, and terminate by a rounded or bifurcated extremity, from the summit of which proceed a multitude of very slender divergent tendons, frequently crossing each other, which attach themselves to the free edge of the mitral valve.

2197. The base of the left ventricle presents two apertures. One of these, the *Left Auriculo-ventricular Orifice*, which is posterior and larger, leads into the auricle, and is nearly elliptical. Like that of the right side, it is margined with a whitish zone, and furnished with a membranous fold which is called the *Mitral Valve*, because its free edge is divided into several slips, to which are attached the cordæ tendineæ, and of which one is applied upon the mouth of the aorta, which it almost entirely closes when the ventricle is dilated. This valve is thicker than the tricuspid valve, and frequently contains small hard fibro-cartilaginous tubercles, and sometimes even bony plates.

The other aperture is to the right and anteriorly of the latter. It leads into the aorta, and is furnished with three *Semilunar valves*, similar to those at the entrance of the pulmonary artery (2186). It is above their free edge that the orifices of the two coronary arteries of the heart are seen. This orifice of the aorta is margined with a callous ring, forming the true boundary between the tissue of the heart and that of the artery. It is right to observe also, that in the places which correspond to the sigmoid valves, the walls of the aorta are depressed and form three prominences at the exterior.

f. ORGANIZATION OF THE HEART.

2198. *Muscular Tissue of the Auricles.*—The walls of the auricles are much thinner than those of the ventricles, which evidently depends upon the smaller quantity of muscular fibres which enter into their formation. In the *Right Auricle*, the muscular tissue constitutes a pretty thick layer of longitudinal fibres towards the point of union of the two venæ cavæ, where it is separated from the serous lamina of the pericardium by a considerable quantity of fat. In the rest of the auricle, this tissue only presents itself in the form of bundles crossing each other, projecting at the anterior and thinner, in the interval of which the serous lamina of the pericardium is in immediate contact with the inner membrane of the cavity. These bundles, although smaller, are more numerous in the appendage. One of them surrounds the orifice of the vena cava superior in a circular manner. The disposition which we have just pointed out causes a part of the right auricle to appear transparent.

In the *Left Auricle*, the fleshy layer is much thicker and more uniform than in the right. Here the muscular fibres seem to come from the pulmonary veins on which they begin to appear by parallel bundles from the moment when these vessels issue from the lungs. On the auricle itself, they retain their original direction at the surface, and form a transverse plane; but more deeply, they cross each other irregularly, without however being disposed in isolated bundles as in the right auricle.

Between the two auricles, the muscular tissue forms a thicker and more uniform layer, from which results the inter-auricular septum.

2199. *Muscular Tissue of the Ventricles.* The walls of the *right ventricle* are rather thin. A uniform fleshy layer invests them externally. More deeply, the muscular tissue collects into bundles disposed like those of the auricles, but stronger and more numerous; several of these, detached from the walls of the cavity, give rise to the columnæ carneæ.

The *Left Ventricle* has much thicker walls than the right. Its superficial fibres seem directed longitudinally from the base to the summit. The middle fibres are intermingled in an inextricable manner. The deeper contribute to the formation of the columnæ carneæ.

In the septum, the muscular fibres of the right ventricle are inerlaced with those of the left, forming very acute angles. They may be separated with patience so as to divide the heart into two portions, the one right and the other left.

2200. The muscular fibres of the heart are extremely numerous and very close upon each other. Their red colour is less florid and darker than that of the muscles of locomotion. Their direction is very difficult to be determined: they intermingle with each other, without any cellular tissue being interposed, as happens in the other muscles, to form distinct bundles of them. Their origin also cannot be determined; they rise from all points of the surface of the organ, without passing over its whole extent. They are leshy in their whole length, the internal columnæ alone being terminated by tendons.

2201. *Membrane of the Right Cavities of the Heart.* It is evidently continuous with the membrane which lines the vessels desined for the circulation of the black blood. On leaving the vena cavæ it covers the whole extent of the auricle, applied upon the muscular bundles, and, in their intervals, against the serous lamina of the pericardium, to which it is united by a dense but spare cellular tissue. Beneath the vena cava inferior it is folded upon tself to form the Eustachian valve, and afterwards that of the coonary vein of the heart. At the circumference of the auriculoventricular orifice, it is separated from the muscular tissue by a layer of thin and semi-fluid fat, which constitutes the white zone of which we have spoken. There also it is folded upon itself, leavng the walls of the organ, to give rise to the tricuspid valves;

after which it covers the whole ventricle, becoming excessively thin, introduces itself into the pulmonary artery, forms at its origin the three semilunar valves, and is continued to the last ramifications of that vessel.

2202. *Membrane of the Left Cavities of the Heart.* It forms part of that which lines the walls of the vessels that carry the rec blood. It commences at the extremities of the pulmonary veins, invests them in their whole extent, covers the whole cavity of the auricle without presenting any fold, and penetrates into the ventricle. But, at the entrance of the latter, its thickness increases a little, and it is folded upon itself to form the mitral valves. In the ventricle it becomes very thick. It leaves that part to procee into the aorta, and from thence into all the arteries of the body It is of it that the three semilunar valves are formed, which are foun in that vessel near its origin.

2203. The arteries of the heart are two in number. They rise immediately from the aorta, and are called *Coronary*. Its veins, which are known under the same name, discharge themselves into the right auricle. Its lymphatics, which are very numerous, go to the ganglia situated before the arch of the aorta and left bronchus. Its nerves, which are also very numerous, and which have already been described, come from the cardiac ganglion (1830). Lastly, we may consider a portion of the serous lamina of the pericardium as entering into the composition of the heart, the latter being invested by it in its whole extent.

II.—*OF THE ARTERIES,* OR VESSELS WHICH CARRY THE BLOOD FROM THE HEART TO ALL PARTS OF THE BODY*

a. GENERAL OBSERVATIONS.

2204. The *Arteries* are vessels which represent a kind of highly ramified tree, of which the common trunk, formed by the aorta, commences at the left ventricle of the heart, and of which the twigs end at the circumference of the body and organs. They are found in all parts of the animal economy in general, with the exception of the hairs, the epidermis, and a few other organs.

From the aorta therefore arise secondary trunks, branches, twigs and ramuscules in great number. It is observed however that for each of the arteries which it furnishes, the number of points of division does not exceed twenty or twenty-five, which is much less than has sometimes been asserted.

In dividing, the branches of the arteries form very variable angles. Thus the superior intercostal arteries leave the aorta at an obtuse angle, the lumbar arteries at a right angle, the spermatic at an acute angle. At the place of each division, in the interior of the vessel, is a prominence which is named the *spur*, and which is formed by the internal membrane. This prominence is circular when the division takes place at a right angle, semi-circular and more distinct when the angle is acute.

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* Ἀρτηρίαι of the Greeks; from ἀήρ, *aer* and τηρεῖν *ferre*, because the ancients supposed them to contain air.

2205. The arteries communicate frequently together by true anastomoses, so that the blood can pass from the one to the other. These anastomoses take place between equal trunks which inosculate, or between a more voluminous trunk and a small twig which join each other. In the former case, the anastomoses forms an acute angle, as when two vertebral arteries unite to form the basilar. Or a transverse branch unites two separate trunks, as in the anterior cerebral arteries; or, lastly, the two trunks inosculate forming an arch, as is seen in the mesenteric arteries.

The more the divisions of the arteries begin to remove from the heart, the more anastomoses do they present. In the last twigs, these inosculations are so numerous as to constitute an inextricable lacework.

2206. Viewed in a general manner, the arteries form an assemblage of vessels which go on decreasing in succession; but on comparing them with each other, it is discovered that this progressive decrement is far from being a constant law. Frequently two or three branches arising from the same trunk have each the volume of the trunk itself. Frequently, also, very small ramifications come directly from the largest branches.

Another remarkable circumstance is, that the calibre of the arteries does not diminish in the ratio of the number and volume of the branches which they furnish. Thus the aorta is nearly as voluminous before the lumbar vertebræ as at the moment of its origin. In this manner each artery is cylindrical, and instead of considering their aggregate as a series of cones whose bases are directed towards the heart, and their summits towards the organs, we must view them as a series of cylinders successively added to each other, and successively decreasing.

A third general consideration is, that the sum of the united diameters of all the arterial twigs much exceeds the diameter of the aorta, so that the arteries may be viewed as constituting, in their aggregate, a cone of which the summit ends in the heart, while its base embraces all the rest of the body.

2207. The last divisions of the arteries ramify to infinity, and form networks which cover all the parts, and which themselves produce others, whose disposition varies, and from which the veins and exhalent organs seem to come. But in what precise manner the communication between the arteries and veins takes place, the most minute inquiries have not yet satisfactorily been made known. The existence of such a communication, however, is placed beyond doubt.

2208. The arteries are composed of three membranes lying upon each other, which are named *Coats*. The innermost of these membranes is a continuation of that which lines the left cavities of the heart (2202). It is very thin, fine, transparent, absolutely destitute of fibres, smooth, and as if serous. It breaks and tears with the greatest facility. Externally, there occurs another dense and compact coat, which seems to be continuous with the surrounding cellular tissue, and which is formed of laminæ pressed against each other, and capable of being reduced to cellular tissue by maceration. It is commonly named the *Cellular Coat.*

But it is the coat which is placed between these two that properly forms the arteries. It is dense, close, thick in proportion to the calibre of the trunks, yellowish, sometimes grayish, composed of very distinct fibres, adhering to each other, easily separable, however, disposed in concentric layers, nearly circular, and intimately uniting externally to the cellular coat, but having very little attachment to the internal membrane. None of these fibres follow a longitudinal direction. They are of a very peculiar nature, but do not at all appear to be muscular; and the name of *Muscular Coat,* which many anatomists have bestowed upon them, has been improperly applied to them. They are hard, fragile, possessed of little extensibility, very elastic, and not filamentous. Their interstices are not filled with cellular tissue. Putrefaction seizes them with great difficulty, and they are prodigiously hardened by the action of caloric.

2209. The walls of the arteries receive minute arteries which form very complicated net-works at their surface, and to which succeed less apparent venules, which go to the neighbouring trunks. No lymphatics have yet been traced in them. Their nerves are pretty distinct, and come especially from the system of the ganglia.

b. OF THE ARTERIES IN GENERAL.

OF THE AORTA.*

2210. The *Aorta* arises from the base of the left ventricle (2197); but it is only really connected with the heart by the inner membrane of that ventricle, which prolongs itself into its interior, and there forms three semilunar valves. The proper membrane or coat of the artery is in no way continuous with the fleshy fibres of the heart; but it commences by three semicircular festoons, which correspond to each of the semilunar valves, and which leave between them and the muscular fibres an interval of two or three lines, so that they give rise to small triangular spaces in the places where their extremities approach each other.

2211. At the moment of its origin, the aorta is concealed by the pulmonary artery, which leaves it at the end of a few lines, because the aorta immediately after its origin directs itself upwards and to the right. It presently ascends before the vertebral column, describing a curve, the convexity of which is to the right and forwards, and which extends as far as opposite the fourth or third dorsal vertebra. It there entirely disengages itself from the pericardium, in order to occupy the middle of the vertebral column. It then continues to bend, directing itself a little backwards and to the left almost transversely, opposite the second dorsal vertebra, and as far as above the left branch of the pulmonary artery. This second curve is called the *Arch of the Aorta.* In subjects advanced in age, it presents at its commencement a certain enlargement which appears owing to the force of the blood, and which some authors have named the *Great Sinus of the Aorta.* It ends on the left side of the body of the third dorsal vertebra. Proceeding from this point, the aorta entirely changes its direction, and becomes vertical. It descends in the posterior mediastinum, upon the anterior and left part of the other dorsal vertebræ, arrives at the diaphragm, enters along with the thoracic duct, between its two pillars, by means of an aperture which belongs peculiarly to itself (874), and introduces itself into the abdomen, where it terminates, bifurcating at the level of the fourth or fifth lumbar vertebra. From the end of the arch to its division, the aorta assumes the name of *descending,* and is distinguished into *Thoracic Aorta* and *Abdominal Aorta.*

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* Ἀορτὴ of the Greeks.

2212. While within the pericardium, the aorta is embraced, to the left and posteriorly, by the pulmonary artery and its right branch. To the right it corresponds to the vena cava superior and lung. Anteriorly, the mediastinum separates it from the sternum.

In its arch, this artery is at first immediately applied upon the trachea, a little before the commencement of the bronchi, and afterwards upon the bodies of the second and third vertebræ.

So long as it remains in the posterior mediastinum, the aorta lies upon the left part of the vertebral column, to the left of the œsophagus, thoracic duct and vena azygos, covered at first by the origin of the bronchi and afterwards by the pericardium. The pleura covers it on its left side.

In the abdomen, it corresponds posteriorly to the anterior part of the bodies of the lumbar vertebræ, to the right to the vena cava inferior, to the left and before to the peritoneum, the stomach, and the small intestine.

1. OF THE ARTERIES WHICH THE AORTA GIVES OFF AT ITS ORIGIN.

OF THE RIGHT CORONARY ARTERY OF THE HEART, OR POSTERIOR CARDIAC ARTERY.

2213. It arises from the aorta immediately above the free edge of one of the semilunar valves (2197), to the right side of the pulmonary artery, and opposite the base of the right ventricle. It presently proceeds from within outwards, in the groove which separates the right auricle from the corresponding ventricle, the aorta, and pulmonary vein. It describes several flexuosities, winds over the base of the heart, arrives at its free edge, changes its direction, and gains the groove which prevails upon the posterior surface of that organ. There, it divides into two considerable branches, of which the larger follows the same groove as far as the summit of the heart, while the other directs itself transversely between the left auricle and ventricle, and descends upon the thick edge of the heart to its extremity.

2214. At the moment of its commencement, the right coronary artery gives off very slender ramifications, which are distributed to the aorta and right auricle. One of them loses itself upon the commencement of the pulmonary artery and in the fat which surrounds it, and anastomoses with a twig of the left coronary artery. Afterwards, five or six other small branches ascend upon the right auricle, three before and three behind, and extend over the venæ cavæ and the inter-auricular septum; while some others, of larger size, and indeterminate number, descend and ramify upon the two surfaces of the right ventricle. The most remarkable of these latter follows the free edge of the heart, separates into two twigs, and anastomoses upon the summit of the organ with the left coronary artery.

2215. The branch which creeps in the posterior groove of the heart sends a certain number of twigs to the right and left, over the corresponding wall of the two ventricles. They are prolonged as far as the two edges of the organ. It also furnishes two or three pretty large trunks, which dive horizontally into the septum of the ventricles, and there unites with those of the opposite coronary artery.

2216. The other branch throws backwards small twigs over the left auricle, and others of somewhat larger size over the ventricle of the same side. In descending along the thick edge of the heart, it gives off ramifications which anastomose with those of the preceding branch or of the left coronary artery.

OF THE LEFT CORONARY OR ANTERIOR CARDIAC ARTERY.

2217. Much smaller than the preceding, and a little higher, it arises like it from the commencement of the aorta, but to the left side of the pulmonary artery. It immediately directs itself downwards and a little to the left and forwards, between the pulmonary artery and the left auricle, by the appendage of which it is at first entirely concealed. It then enters the groove of the anterior surface of the heart, and runs along its whole extent to the summit of the organ.

2218. Before arriving at the base of the ventricle, the left coronary artery gives off no branch; but there, it sends to the right a rather small branch which goes to be distributed to the aorta and pulmonary artery, and a more considerable one to the left, which winds between the auricle and ventricle, and descends upon the thick edge of the heart, subdividing into several twigs which anastomose with one of the branches of the preceding artery. Frequently also on the same place there arises a third branch which penetrates vertically into the septum of the ventricles.

2219. In the anterior groove of the heart, the artery of which we speak sends off laterally several more or less oblique branches, which subdivide in the anterior wall of the two ventricles, particularly of the left, and which, towards the summit of the heart, inosculate with those of the right coronary artery. Others, unimportant as to size and of an indeterminate number, separate from it posteriorly to lose themselves in the septum of the ventricles.

2. OF THE ARTERIES WHICH ARISE FROM THE ARCH OF THE AORTA.

2220. The convexity of the arch of the aorta produces three arterial trunks, destined for the head and superior extremities, and which are designated, proceeding from right to left, by the names of *Brachio-cephalic* or *Arteria innominata*, *Left Carotid*, and *Left Subclavian arteries.*

These three arteries arise in the course of a line inclined from before backwards and from right to left, so that the brachio-cephalic is anterior and the left subclavian posterior to the others. The first two, which are very close to each other, include between them the trachea.

Frequently the left vertebral artery comes directly from the arch of the aorta, and forms a fourth trunk. It is also not uncommon to see a small artery issuing between the brachio-cephalic and left carotid, and descending upon the trachea as far as the thyroid body.

2221. The *Brachio-Cephalic Artery*, which is also named the *Arteria innominata*, ascends obliquely to the right, on the side of the trachea, and after a course of an inch, divides into two trunks, of which one is the right carotid, the other the subclavian of the same side. It is covered by the left subclavian vein, the sternum, and the sterno-thyroidei muscles, and corresponds posteriorly to the trachea and longus colli muscle of the right side.

2222. The left carotid artery forms a right angle with the aorta at its origin, and the subclavian of the same side comes off obliquely, as does the brachio-cephalic.

OF THE COMMON CAROTID ARTERIES.

2223. We are already acquainted with their difference of origin, which makes the left longer than the right by the whole extent of the brachio-cephalic trunk. Their volume is precisely the same. They ascend a little obliquely outwards on each side of the neck, to the upper part of the larynx, where they divide into two branches, the external carotid and the internal carotid.

Inferiorly the right carotid is a little anterior to the left, but as it ascends it places itself in the same plane.

The interval which these two arteries leaves between them is filled below by the trachea and œsophagus, and above by the larynx.

2224. *Anteriorly*, the left carotid is covered in its lower part by the left subclavian vein, the thymus gland and the clavicle.

Both are then placed in the interval of the sterno-cleido-mastoidei, sterno-hyoidei, thyro-hyoidei, and omo-hyoidei muscles, by which they are separated from the platysma myoides, which, however, almost immediately covers them above.

2225. *Posteriorly*, the common carotids are applied upon the vertebral column, and more immediately upon the inferior thyroid arteries, and the longi colli and recti capitis antici majores muscles.

2226. *Internally*, they correspond to the trachea, the thyroid body, which advances a little upon them, the larynx and the pharynx. That of the left side is moreover in relation with the œsophagus.

2227. *Externally*, they are coasted by the internal jugular vein, the pneumo-gastric nerves, and the communicating cords of the superior and middle cervical ganglia (1806). All these parts are connected by a filamentous cellular tissue, having little fat, and filled with lymphatic ganglia.

2228. In their whole course, the common carotid arteries preserve the same calibre. In fact they give off no branch, excepting some very slender ramifications which lose themselves in their own walls or in the neighbouring muscles.

OF THE EXTERNAL CAROTID ARTERY.

2229. This artery is particularly destined for the face and the exterior of the skull. Its volume is equal to that of the internal carotid, excepting in young children, in whom the latter is larger, on account of the greater development of the brain and organs o sense.

2230. The external carotid artery extends from the upper par of the larynx to the neck of the condyle of the lower jaw. Place near the internal carotid at its commencement, and even situate internally and anteriorly of it, it ascends parallel to it until unde the digastric muscle, where it crosses its direction winding outwards and backwards to gain the angle of the jaw, and becom more superficial.

It then proceeds between the ear and the posterior edge o the lower jaw, concealed by the parotid gland, and divides into two branches which are named the *Temporal* and *Internal Maxillary Arteries.*

2231. Inferiorly, the external carotid is only covered by the platysma myoides and the skin; but it presently sinks under the hypoglossal nerve and the digastricus and stylo-hyoideus muscles, and lastly under the parotid gland. Internally, it is in relation below with the internal carotid artery, at the middle with the stylo-pharyngei and stylo-glossi muscles, and above with the styloid process of the temporal bone.

2232. The branches which this artery furnishes may be distinguished into those which arise from its anterior part, which are three in number, and are named the *Superior Thyroid*, *Facial* and *Lingual Arteries*; those which come from its posterior region, which are two in number, and are called the *Occipital* and *Auricular Arteries*; that which issues from its inner side, the *Inferior Pharyngeal Artery*; and, lastly, those by which it terminates, the *Temporal* and the *Internal Maxillary Arteries*.

ANTERIOR BRANCHES OF THE EXTERNAL CAROTID ARTERY.

a. OF THE SUPERIOR THYROID ARTERY.

2233. Situated at the fore and upper part of the neck, it extends from the external carotid to the thyroid body and larynx. It arises from the fore part of the external carotid, very near its origin, and even sometimes opposite to it, then descends inwards and forwards towards the side of the larynx, where it changes its direction, and proceeds almost vertically downwards, towards the summit of the corresponding lobe of the thyroid body, where it arrives after describing different sinuosities, which vary in different subjects. In this course it is covered, from without inwards, by the platysma myoides, omo-hyoideus, and sterno-thyroideus muscles, to which it gives some small ramifications, which arrive at the skin and other neighbouring muscles, as the sterno-cleido-mastoideus, sterno-hyoideus, thyro-hyoideus, and constrictor pharyngis medius.

2234. *Laryngeal Branch.* Towards the upper part of the larynx, the superior thyroid artery furnishes this branch, which directs itself transversely behind the thyro-hyoideus muscle over the thyroid membrane, gives the latter some small twigs, which are also distributed to the muscles of the hyoid bone, and anastomose with those of the opposite side, and traverse it in company with the internal-laryngeal nerve of the pneumo-gastric (1680). On entering the larynx, this twig bifurcates. One of its branches throws itself into the crico-arytenoideus lateralis, and crico-thyroideus muscles; the other winds around the base of the arytenoid cartilage, and loses itself in the crico-arytenoideus posticus muscle. Both unite with those of the opposite side, and send a prodigious number of ramifications over the epiglottis, and the mucous membrane of the larynx.

2235. *Crico-thyroid Branch.* A little smaller than the preceding, it descends obliquely inwards over the thyroid cartilage, gives twigs to the thyro-hyoideus muscle, and passes transversely over the crico-thyroid membrane, at the middle of which it anastomoses with that of the opposite side, after furnishing ramifications to the crico-thyroideus muscle.

2236. When the superior thyroid artery has arrived at the thyroid body, it separates into three branches. One of these dives between the thyroid body and the walls of the larynx. Another, which is larger, proceeds along its outer edge. The third follows its inner edge, and before the cricoid cartilage unites by a reversed arch with the like branch of the opposite superior thyroid artery, while the two first anastomose with the twigs of the inferior thyroid artery of the same side. They are all distributed, by a great number of divisions, in the parenchyma of the thyroid body.

OF THE FACIAL, OR LABIAL, OR EXTERNAL MAXILLARY ARTERY.

(*Artère palato-labiale*, Chauss.)

2237. It extends to almost all the regions of the face as far as the root of the nose. It arises from the fore part of the external carotid, above the lingual artery, and behind the digastricus muscle. Its size is considerable. Immediately after its origin, it directs itself almost transversely inwards and forwards; and, after describing several flexuosities, gains the inner part of the angle of the lower jaw, covered in this course by the hypoglossal nerve, the digastricus and stylo-hyoideus muscles and the sub-maxillary gland. It then bends back between that gland and the base of the inferior maxillary bone, changes its direction, ascends very obliquely towards the commissure of the lips, between the triangularis and masseter muscles, forms a great number of flexuosities, and is covered by the skin and the platysma myoides. Near the free edge of the upper lip, it enters under the union of the levator anguli oris and triangularis muscles, and ascends upon the side of the nose, as far as the inner angle of the eye, where it terminates, whether by anastomosing with the nasal twig of the ophthalmic artery or with the infra orbitar, or by spreading out its twigs in the neighbouring parts. In the second part of its course, the facial artery is separated from the skin by a greater or less quantity of fat, and corresponds successively and posteriorly to the inferior maxillary bone the buccinator muscle, from which it is separated by a mass o adipose tissue of which we have already repeatedly spoken, the orbicularis oris, levator labii superioris and levator labii superioris alæque nasi.

BRANCHES WHICH THE FACIAL ARTERY GIVES OFF UNDER THE JAW.

2238. *Inferior Palatine Branch.* It is of very small size, and comes off from the facial artery a few lines above its origin. Sometimes it even comes from the external carotid. It immediately ascends between the stylo-pharyngei and stylo-glossi muscles, furnishes them with some ramifications, applies itself against the lateral and superior wall of the pharynx, arrives between the pillars of the velum palati, and separates into a great number of small twigs which are distributed to the pharynx, the corresponding tonsil and the Eustachian tube. Some of them ascend into the velum palati and lose themselves in its muscles and membranes or anastomose with those of the superior palatine artery.

2239. *Submental Branch.* It is furnished by the facial artery near the base of the jaw, and is larger than the preceding. Directed forwards, between the platysma myoides, digastricus and mylohyoideus, it runs along the attachment of the latter muscle, furnishes it with a great number of twigs, which pass through its substance to anastomose with those of the sublingual artery, which is itself frequently a division of the submental. Near the median line it bifurcates. One of the twigs passes before the origin of the digastricus muscles, and unites with that of the opposite side. The other ascends upon the chin, and after giving twigs to the integuments, inosculates with the ramifications of the inferior dentar artery which escape by the mental foramen.

2240. Besides these two branches, the facial artery furnishes, in its lower half, several small twigs which lose themselves in the muscles of the superior hyoid region, and in the substance of the maxillary bone. There also separate from it a great number which penetrate the submaxillary gland, and subdivide there. Some of them ascend as far as the pterygoideus internus, or are distributed to the mucous membrane of the mouth and the corresponding side of the tongue.

BRANCHES WHICH THE FACIAL ARTERY TO GIVES THE FACE.

2241. *External Branches.* They are pretty numerous, but their volume is small and their disposition variable. They are distributed in the masseter, platysma-myoides and buccinator muscles, in the adipose cellular tissue and skin of the cheek, on Steno's duct, and on the parotid gland. Some of them communicate with the twigs of the transverse and buccal arteries.

2242. *Internal Muscular Branches.* They are distributed to the triangularis and quadratus muscles, as well as to the skin of the chin, and anastomose with the ramifications of the submental artery, and with those of the inferior dentar artery which issue by the mental foramen.

2243. *Inferior Coronary* or *Labial Branch.* Larger than the preceding branches, it arises from the facial artery at a considerabl distance from the commissure of the lips, passes under the triangularis muscle, and advances tortuously in the substance of th free edge of the under lip, on the middle of which it joins the opposite coronary branch, after sending numerous twigs to the membrane of the mouth, and to the orbicularis, triangularis, quadratu and levator menti muscles. These last form a very complicate net-work in the integuments, by their numerous anastomoses wit the ramifications of the submental and inferior dentar arteries.

2244. *Superior Coronary* or *Labial Branch.* It arises abov and very near the commissure. Large and flexuous, it proceed inwards in the substance of the edge of the upper lip, at the middle of which it anastomoses with that of the other side by a particular twig, ascending itself vertically towards the septum of th nose on which it terminates. Its ultimate twigs form a very complex net-work in the mucous membrane of the upper lip, in th integuments and orbicularis oris and depressor alæ nasi muscles Some of them go to the gums and unite with those of the alveola artery.

2245. *Dorsal Branches of the Nose.* These vary much i number and disposition. Sometimes they terminate the faci artery, which then only communicates by a twig with the ophtha mic. Frequently also they occupy only the lower part of the nose while, in other cases, they are uniformly distributed in its whol extent. But they always anastomose in the median line with thos of the opposite side, and are distributed to all the parts of that o gan, its muscles, cartilages, integuments, &c. Several of their ramifications turn over the edge of the nostrils, or pass through th fibro-cartilages, to gain the commencement of the pituitary men brane.

2246. *Superior Muscular Branches.* Their number vari much. They are very small and are distributed in an irregul manner to the levator anguli oris, levator labii superioris, levat labii superioris alæque nasi, zygomaticus minor and orbicularis pa pebrarum, as well as in the integuments. They communicate wi the ramifications of the infra-orbitar and ophthalmic arteries.

C. OF THE LINGUAL ARTERY.

2247. It arises from the fore part of the external carotid arter between the two preceding arteries, and a little more deeply th they, behind the digastricus muscle. Not unfrequently it com from a trunk which is common to it with the facial artery. ascends at first a little, winding and directing itself inwards a forwards. It then enters between the hyo-glossus muscles, near inferior attachment, and the constrictor pharyngis medius; after which, bending upwards, it ascends between the hyo-glossus and genio-glossus muscles, and between the latter and the sublingual gland, above the great horn of the hyoid bone, as far as the root of the tongue. There, it changes its direction again, becomes horizontal, and, under the name of the *Ranine Artery*, advances, accompanied by the lingual nerve, between the genio-glossus and lingualis muscles, to the point of the tongue, where it anastomoses with that of the other side by an arch.

This artery is consequently nearly horizontal from its commencement, to the moment when it bends back towards the anterior edge of the hyo-glossus muscle. It is vertical during its course along the genio-glossus muscle, and horizontal again from the base to the point of the tongue. This disposition allows it to be distinguished into three portions.

2248. Under the hyo-glossus muscle and behind it, the lingual artery furnishes some inconsiderable branches, which are distributed to that muscle and the constrictor pharyngis medius. Some others pass through it, and arrive at the thyro-hyoideus and digastricus muscles. There are some which throw themselves into the genio-glossus muscle, and anastomose with those of the opposite side. It is from the same point also that the *Dorsal Artery of the Tongue* arises, which directs itself upwards and outwards toward the base of that organ and the epiglottis, and whose ramifications are chiefly distributed to the stylo-glossus muscle, the back of the tongue, the tonsils and the velum palati. Although some authors mention this branch as constant, I have yet very frequently found it wanting.

2249. Upon the genio-glossus, there are detached from the lingual artery several twigs which penetrate that muscle. But there also arises from the same place a larger branch, which is named the *Sublingual Artery*, and which is sometimes a division of the submental (2239). Directed horizontally forwards between the mylo-hyoideus and genio-glossus, and above the sublingual gland, this artery furnishes a great number of twigs to those parts and to the mucous membrane of the mouth. Some of them unite with those of the submental, or of the sublingual artery of the other side. There are some also which pass through the mylo-hyoideus muscle, and arrive at the posterior belly of the digastricus.

2250. Lastly, under the tongue, the lingual artery gives off laterally a great number of large twigs which lose themselves in the lingualis and genio-glossus muscles, and in the tissue of the tongue, anastomosing with each other, and with those of the opposite side. At the very tip of the tongue, and above the frenum of that organ, the two lingual arteries, which have assumed the name of *ranine*, anastomose with each other.

POSTERIOR BRANCHES OF THE EXTERNAL CAROTID ARTERY.

a. OF THE OCCIPITAL ARTERY.

2251. It arises from the posterior part of the external carotid, under the parotid gland, and opposite the lingual artery, and extends as far as the occiput. It ascends at first obliquely backwards, beneath the sterno-cleido mastoideus muscle, along the posterior belly of the digastricus muscle and the hypo-glossal nerve. It then passes horizontally between the transverse process of the atlas and the mastoid process, after crossing the direction of the internal jugular vein and pneumo-gastric nerve, above which it is situated. It then bends back upon the occipital bone, covered by the splenius muscle, under the inner edge of which it emerges to become subcutaneous, and ascend in a tortuous manner upon the back part of the head where it terminates.

2252. *Branches of the Deep Portion.* Some of these, which are *superior*, and of small size, are distributed to the digastricus, sterno-cleido-mastoideus and stylo-hyoideus muscles, and communicate with the twigs of the deep cervical branch. One of them, which is larger and more constant than the others, bearing the name of *Posterior Mastoid Artery*, introduces itself into the skull by the mastoid foramen, and loses itself in the portion of the dura mater which lines the posterior and lateral fossæ of the skull.

The others, which are *inferior*, descend in the substance of the sterno-cleido-mastoideus, splenius and complexus minor muscles, where they anastomose with the ramifications of the deep cervical and vertebral arteries.

2253. *Branches of the Subcutaneous Portion.* They are very numerous. The *inferior* lose themselves in the muscles of the posterior region of the neck, and occasionally extend as far as the back. The *superior* ascend in a tortous manner along the course of the lambdoid suture, and ramify in the integuments and occipitalis muscle, anastomosing with the divisions of the opposite occipital artery, or with those of the temporal and posterior auricular arteries of the same side. Frequently one of their twigs passes through the parietal hole, and loses itself in the dura mater.

b. OF THE POSTERIOR AURICULAR ARTERY.

2254. This is one of the smallest branches of the external carotid artery, from which it separates in the substance of the parotid gland, above the digastricus muscle, to extend to the inner surface the auricle and over the side of the head. It ascends at first backwards, covered by the gland, between the mastoid process and auditory canal. On arriving at the lower part of the auricle, it bifurcates. One of its branches, placed before the other, expands over the inner surface of the auricle, between the skin and the fibro-cartilage. The other, which is posterior, passes over the mastoid process, and divides into a multitude of twigs which belong to the temporalis and retrahens auriculam muscles, the epicranial aponeurosis, the cellular tissue and integuments of the lateral part of the head.

2255. But previous to this bifurcation, the artery sends some small twigs into the parotid gland, the stylo-hyoideus and digastricus muscles, and the walls of the auditory canal. It also furnishes the *Stylo-mastoid Artery*, which sometimes comes from the occipital, and which, after sending some ramifications into the auditory canal and upon the membrana tympani, enters, by the stylo-mastoid foramen, into the aqueduct of Fallopius, runs along it, spreads out its subdivisions in the mucous membrane of the tympanum, the mastoid cells, the semicircular canals, the muscle of the stapes, the periosteum of the aqueduct itself, &c. where it terminates by anastomosing with a twig of the middle meningeal artery, which has penetrated by the hiatus of Fallopius.

INTERNAL BRANCH OF THE EXTERNAL CAROTID ARTERY, OR INFERIOR PHARYNGEAL ARTERY.

2256. This branch is smaller than the posterior auricular artery, and is more deeply situated than the other branches of the external carotid, from which it arises at the same level as the facial. It ascends at first vertically along the lateral and posterior part of the pharynx, between the external and internal carotids, covered below by the stylo-pharyngeus muscle, and above by the constrictor superior.

2257. After a short course, and after furnishing some irregular twigs which descend obliquely behind the pharynx and in its constrictor muscles, this artery divides into two branches of equal size.

2258. *Pharyngeal Branch.* Lying transversely upon the constrictor pharyngis superior, it divides into two or three twigs, of which one is distributed to that muscle, ascending in its substance, while the others, proceeding obliquely downwards, lose themselves in the two corresponding middle and inferior constrictors. Its last divisions anastomose with some twigs of the superior thyroid and lingual arteries.

2259. *Meningeal Branch.* It ascends between the internal carotid, the pneumo-gastric nerve and the internal jugular vein, gives ramifications to these different parts, to the superior cervical ganglion, the Eustachian tube, rectus capitis anticus major, rectus anticus minor and longus colli muscles, and at length introduces itself into the skull by the foramen lacerum posterius, to ramify upon the dura mater. Some of its twigs penetrate separately into that cavity, and have the same destination. One in particular is observed which passes through the fibro-cartilage of the foramen lacerum anterius. Another passes through the anterior condyloid foramen.

BRANCHES WHICH TERMINATE THE EXTERNAL CAROTID ARTERY.

a. OF THE TEMPORAL ARTERY.

2260. Not so large as the internal maxillary artery, from which it separates opposite the neck of the condyle of the jaw, and following the original direction of the external carotid, this artery ascends at first a little obliquely outwards between the ramus of the jaw, the auditory canal, and the parotid gland which covers it as far as the zygomatic arch. But above the latter, it glides in a tortuous manner under the anterior and superior muscles of the ear, and becomes subcutaneous. Arrived at the middle of the temporal region, it divides into two branches, an anterior and a posterior.

2261. *Anterior Twigs.* The temporal artery gives off a certain number of twigs which direct themselves forwards toward the masseter and the articulation of the lower jaw. Among these there is to be distinguished the *Transverse Artery of the face*, which arises from the temporal immediately after its origin, varies much in size, passes over the neck of the condyle of the jaw, gives off a twig which is distributed in the masseter, and there anastomoses with a division of the internal maxillary artery, crosses the direction of that muscle, proceeding under Steno's duct, and terminates opposite its anterior edge, ramifying to infinity on that duct, in the parotid gland, in the two zygomatici and orbicularis palpebrarum muscles, as well as in the integuments. Several of its twigs anastomose in the substance of the cheek with those of the facial, buccal, and infra-orbitar arteries.

2262. *Posterior Twigs.* They are of considerable size and vary in their number. They are called the *Anterior Auricular Arteries*, and are distributed to the external auditory canal and to the auricle.

2263. *Internal Twig* or *Middle Temporal Artery.* It comes from the temporal artery immediately above, and sometimes under the zygomatic arch. It almost immediately perforates the aponeurosis of the temporal muscle, into which it dives, and where it separates into a great number of ramifications, of which several are seen to communicate with the deep temporal arteries.

2264. Of the two branches by which the temporal artery terminates, the anterior ascends in a serpentine manner towards the forehead, and subdivides into a great number of twigs which run in all directions, and diffuse themselves in the frontalis and orbicularis palpebrarum muscles, and in the integuments. Of these twigs, some which are transverse, anastomose with the frontal and superciliary arteries, while the others bend towards the top of the head, where they meet those of the opposite side.

The posterior branch ascends obliquely over the parietal and occipital bones, describes there a great number of sinuosities, and gives off many twigs which are uniformly spread out in all directions in the integuments, the aponeurosis of the temporal muscle, the attolens auriculam and the pericranium, communicating with those of the anterior branch, and of the opposite temporal, occipital and posterior auricular arteries.

OF THE INTERNAL MAXILLARY ARTERY.

(*Art. Gutturo-maxillaire*, Chauss.)

2265. More voluminous than the temporal, it arises from the external carotid at the same point as it, and is remarkable for its complex course and for the great number of important branches which it gives off to the deep parts of the face. Immediately after its origin, it dives beneath the neck of the condyle of the jaw, bending inwards and downwards, then advances directly inwards, passes between the dentar and lingual nerves, and arrives in the interval which separates the two pterygoidei muscles, where it changes its direction in a little to proceed forwards over the maxillary tuberosities. It then bends, becomes vertical, glides between the two fixed insertions of the pterygoideus externus muscle (987), in the bottom of the zygomatic fossa between it and the temporalis muscle. Finally, arriving near the floor of the orbit, it again takes a horizontal and transverse direction, dives into the spheno-maxillary fossa, and divides into several branches in the middle of the adipose cellular tissue which fills that cavity.

The internal maxillary artery is consequently horizontal near its origin and termination, and vertical in the middle. It describes, moreover, several very distinct sinuosities, which vary in different subjects.

BRANCHES WHICH ARISE FROM THE INTERNAL MAXILLARY ARTERY, BEHIND THE NECK OF THE CONDYLE OF THE JAW.

1. OF THE MIDDLE MENINGEAL ARTERY.

2266. This is the largest branch of the internal maxillary artery. It ascends vertically towards the skull, between the two pterygoidei muscles, and accompanied by two filaments of the inferior maxillary nerve which go to unite with the facial nerve. It gives off at first some small twigs to the pterygoideus externus, peristaphylinus externus, and constrictor pharyngis superior muscles, as well as to the temporal and sphenoid bones. Some of these latter pass through the sphenoid bone by particular apertures, and lose themselves in the dura mater. It thus arrives at the foramen spinosum of the sphenoid bone, by which it penetrates into the skull. But before this there separates from it a pretty large branch, which glides forwards and inwards, between the superior wall of the zygomatic fossa and the origin of the deep temporal nerves (1590), and afterwards descends vertically between the peristaphylinus externus and pterygoideus internus muscles, in the substance of which it separates into a great number of twigs.

2267. Having entered the skull, under the dura mater, the meningeal artery furnishes twigs to the portion of that membrane which covers the middle lateral fossa of the base of the skull and to the trifacial nerve. One or two of them direct themselves forwards, penetrate into the orbit between the sphenoid bone and the malar bone, and terminate at the lachrymal gland, in the parenchyma of which they communicate with the lachrymal artery. Another enters into the aqueduct of Fallopius by the hiatus of the same name, and anastomoses with the stylo-mastoid artery (2255), after sending some ramifications over the trunk of the facial nerve. The canal of the internal muscle of the malleus also contains one which is distributed to that muscle, and to the mucous membrane of the walls of the tympanum. This cavity itself receives several other smaller ramifications, which penetrate into it by narrow fissures, which are observed at the place where the petrous process unites with the rest of the temporal bone.

2268. After giving off these different twigs, the artery itself divides into two principal branches of unequal size. The *anterior*, which is larger, ascends from behind forwards, towards the anterior and inferior angle of the parietal bone, where it is lodged in a deep groove, and frequently even in a true canal formed at the inner surface of that bone (189). It gives off some twigs, which anastomose with the lachrymal artery, issues from its groove and subdivides into a great number of twigs, which are expanded over the whole internal surface of the parietal bone, which receives them in grooves, disposed so as to resemble the nerves of a leaf, and extending as far as the superior longitudinal sinus of the dura mater (188). All these twigs have the appearance of small tubes formed in the substance of the dura mater. They belong entirely to that membrane, and only send off opposite to the sutures some small twigs, which anastomose with similar twigs of the arteries of the pericranium. The *posterior branch*, which is smaller, ascends, bending from before backwards, upon the inner surface of the squamous portion of the temporal bone, and upon that of the parietal bone. It divides in the same manner into a great number of twigs, which expand over the lateral and posterior part of the dura mater. Like those of the anterior branch, they anastomose frequently together, and correspond to grooves formed upon the bones.

The last ramifications of the middle meningeal artery communicate with those of the opposite artery, of the ethmoidal arteries, and of the other small branches which pass over the dura mater.

2. OF THE INFERIOR DENTAR OR INFERIOR MAXILLARY ARTERY.

(*Art. Maxillo-dentaire*, Chauss.)

2269. It arises inferiorly from the internal maxillary artery, at the same place where the middle meningeal separates from it above, sometimes, however, a little farther. It descends anteriorly along the inner surface of the ramus of the jaw, at the outer side of the pterygoideus internus, behind the inferior dentar nerve, and before the internal lateral ligament of the articulation of the lower jaw, as far as the aperture of the dentar canal (289), which it traverses along its whole extent, to make its appearance again beyond the mental foramen.

2270. Before penetrating into the dentar canal, this artery gives off at first numerous ramifications to the pterygoideus internus and inferior dentar and lingual nerves. Close to the orifice of that canal, it furnishes a twig which descends forwards in a small groove formed upon the inferior maxillary bone along the attachment of the mylo-hyoideus muscle. Accompanied by a filament of the inferior dentar nerve (1597), this twig loses itself by a great number of subdivisions in the mucous membrane of the mouth, and in the mylo-hyoideus muscle.

2271. The trunk of the artery itself then enters the canal, along with the inferior dentar nerve, and sometimes, however, by a separate aperture. As it passes transversely beneath the alveoli, it sends off from its upper side twigs which penetrate into these cavities, and are destined for the roots of the teeth, which admit them by a hole formed at their summits. Under the first small molar tooth it bifurcates. One of its branches, which is very small, emerges by the mental foramen, throws itself into the quadratus and triangularis muscles, and anastomoses with ramifications of the facial artery. The other branch, which is larger, continues its course in the bone to the symphysis of the chin, and gives twigs to the roots of the corresponding canine teeth and incisores.

2272. Frequently, at the very place where the dentar artery arises, the internal maxillary artery furnishes some isolated twigs. One of them ascends upon the temporal bone, behind the auricular canal, and is distributed to its walls, to the membrane of the tympanum, and to the ceruminous follicles (1931). Another penetrates into the tympanum by the glenoid fissure, and gives ramifications to the mucous membrane of the walls of that cavity and to the anterior muscle of the malleus.

BRANCHES WHICH ARISE FROM THE INTERNAL MAXILLARY ARTERY BETWEEN THE TWO PTERYGOID MUSCLES.

1. OF THE POSTERIOR DEEP TEMPORAL ARTERY.

2273. It arises a little after the preceding, and is even sometimes produced by it shortly after its commencement. Concealed at first between the temporalis and pterygoideus externus, it afterwards ascends obliquely under the first of these muscles, becomes vertical, creeps over the temporal fossa, and divides into a great number of ramifications, which are distributed to the periosteum of that fossa, and to the fibres of the temporal muscle. These ramifications anastomose anteriorly with the anterior deep temporal artery, and externally with the middle and superficial temporal arteries.

2. OF THE MASSETERIC ARTERY.

2274. Inferior in size to the preceding, it sometimes arises along with it by a common trunk. Directed outwards, between the posterior edge of the temporal muscle and the neck of the condyle of the lower jaw, it passes over the notch which separates the latter part from the coronoid process (293), throws some small twigs into the upper portion of the masseter muscle, then descends obliquely forwards, between it and the ramus of the maxillary bone, dives into its substance, subdivides and anastomoses there with the transverse artery of the face.

3. OF THE PTERYGOID ARTERIES.

2275. They vary much with respect to their number, size, and origin. They almost all come from the maxillary artery itself, but there are some of them which arise separately from the middle meningeal and posterior deep temporal arteries. They are distributed to the two pterygoidei muscles, and especially to the outer. Their course is very irregular; some of their smallest ramifications accompany the deep temporal nerves.

BRANCHES WHICH ARISE FROM THE INTERNAL MAXILLARY ARTERY IN THE ZYGOMATIC FOSSA.

1. OF THE BUCCAL ARTERY.

2276. It is sometimes wanting. Pretty frequently it does not come from the internal maxillary artery itself, but arises from the anterior deep temporal, or from the alveolar, or lastly from the infra-orbitar. Of very inconsiderable size and very flexuous in its course, it descends obliquely forwards, beside the buccal nerve (1592), between the pterygoideus internus muscle, and the ramus of the jaw, advances towards the cheek, becomes transverse, and separates, at a greater or less distance from the commissure of the lips, into a great number of twigs which are spread out in the buccinator, zygomaticus major, zygomaticus minor, and platysma myoides muscles, the integuments, the mucous membrane of the cheeks, and the mucous follicles of that part. It anastomoses with the facial (2241), infra-orbitar and transverse artery of the face (2261).

2. OF THE ANTERIOR DEEP TEMPORAL ARTERY.

2277. Its volume is pretty considerable. It ascends vertically in the anterior part of the temporal fossa, between the internal and anterior region of the temporalis muscle and the malar and sphenoid bones. One of its twigs enters into the orbit by one of the holes with which the malar bone is perforated, and anastomoses with one of those of the lachrymal artery. Several others of smaller size also pass through the same bone, but lose themselves in the adipose tissue which envelopes the ball of the eye, or upon the lachrymal gland. Lastly, the artery itself terminates by subdividing in the substance of the temporal muscle, where it communicates with the ramifications of the posterior deep temporal artery (2273), and of the middle and superficial temporal arteries.

3. OF THE ALVEOLAR ARTERY.

(*Art. Sus-maxillaire*, Chauss.)

2278. It is of considerable size, and arises opposite the maxillary tuberosity, on which it descends from behind forwards, describing numerous turns. In some cases it comes from the infra-orbitar or anterior deep temporal. After sending some small twigs into the superior and posterior dentar canals (244) for the roots of the large molares and the mucous membrane of the maxillary sinus, it advances tortuously along the gums, to which it gives some ramifications. Arrived at the fossa canina, it still sends a dentar twig to the small molares, and loses itself by subdividing in the cellular tissue of the cheeks, the buccinator muscle, and the periosteum of the maxillary bone, anastomosing with the infra-orbitar by one of its principal twigs.

4. OF THE INFRA-ORBITAR ARTERY.

2279. Of equal size with the anterior deep temporal, it separates from the internal maxillary towards the upper and fore part of the zygomatic fossa, gives at its commencement ramifications to the periosteum and fat of the orbit, and introduces itself into the infra-orbitar canal (238). It traverses it in its whole extent, placed beneath the nerve of the same name (1586), and throws through its walls some twigs into the rectus inferior and obliquus inferior muscles of the eye, into the orbicularis palpebrarum, and over the lachrymal sac. Near the orifice of this canal, it sends a small branch into the superior and anterior dentar canal (238), for the roots of the corresponding canine teeth and incisores, and for the membrane of the maxillary sinus. Emerging at length by the infra-orbitar foramen, behind the levator labii superioris, it separates into a great number of branches, which subdivide in the muscles of the upper lip and upon the lower part of the nose, anastomosing with the facial, alveolar, buccal, and ophthalmic arteries.

BRANCHES WHICH THE INTERNAL MAXILLARY ARTERY PRODUCES IN THE SPHENO-MAXILLARY FOSSA.

1. OF THE VIDIAN OR PTERYGOID ARTERY.

2280. It is very slender and sometimes comes from the superior palatine. It enters, along with the vidian nerve (1801), into the pterygoid canal, runs through its whole length from before backwards, and issues from it to be distributed to the Eustachian tube and the vault of the pharynx, after sending some small twigs into the spongy tissue of the sphenoid bone and the membrane of the sphenoidal sinuses. Its ramifications anastomose particularly with those of the inferior laryngeal (2256).

2. OF THE PTERYGO-PALATINE OR SUPERIOR PHARYNGEAL ARTERY.

2281. Still smaller than the preceding, it directs itself obliquely backwards and upwards, and enters a little internally and inferiorly of it, into the pterygo-palatine canal, to proceed backwards to terminate at the pharynx, like the pterygoid, after giving some small twigs to the cellular tissue of the sphenoid bone and the Eustachian tube. It sometimes arises from the spheno-palatine.

3. OF THE SUPERIOR PALATINE ARTERY.

2282. Much larger than the two last, it separates from the internal maxillary behind the summit of the orbit, descends vertically in the pterygo-maxillary fissure, and enters the posterior palatine canal. Before entering, it furnishes three or four twigs which penetrate into the accessory palatine canals, and issue from them on the tuberosity of the same name to be distributed to the velum palati. With respect to the trunk itself, after leaving its canal, it is reflected from behind forwards between the membrane and the vault of the palate, lodged in a particular groove of the latter. In this course, the artery is very flexuous, and furnishes a great number of twigs to the mucous membrane and follicles of the palate. One of these twigs ascends to the nasal fossæ by the anterior palatine foramen.

4. OF THE SPHENO-PALATINE ARTERY.

2283. This may be considered as the terminating branch of the internal maxillary artery. It penetrates to the posterior part of the superior meatus of the nasal fossæ (356) by the spheno-palatine foramen. There, beneath the pituitary membrane, it divides into two or three principal twigs; but frequently this division takes place previously, and in the spheno-maxillary fossa itself. One of these twigs is distributed to the septum of the nasal fossæ. The others lose themselves around the ethmoidal turbinated bone, in the superior and middle meatus, the maxillary sinus and the posterior ethmoid cells. Their ramifications anastomose with those of the ethmoid arteries, and give a deep red tint to the pituitary membrane, on account of their great number and their superficial position.

OF THE INTERNAL CAROTID ARTERY.

2284. It separates from the external behind the digastricus muscle, enters the space which exists between the ramus of the inferior maxilla and the pharynx, and ascends a little inwards before the vertebral column, becoming deeper and deeper as it approaches the skull, into which it introduces itself by the carotid canal. It is accompanied externally by the internal jugular vein, internally by the pneumo-gastric nerve, the superior cervical ganglion and the twig by which it communicates with the middle cervical ganglion. It is connected with these different parts by a loose and filamentous cellular tissue. Its direction is by no means rectilinear. It forms at first a curve whose convexity rests upon the vertebral column, and near the skull presents another having its convexity directed outwards. These flexuosities are extremely variable, and are very rarely found the same in two subjects. In all this part of its course, the internal carotid artery furnishes no branch.

2285. In passing through the carotid canal, it accommodates itself to the different directions which it follows (179), so that from being at first vertical, it afterwards directs itself a little obliquely forwards and upwards. This portion of the internal carotid artery is in relation with the ascending filaments of the superior cervical ganglion (1805) and the lamina of the dura mater which lines the canal. Before emerging, it gives off a small branch, which penetrates by a particular aperture into the cavity of the tympanum, to be distributed to its mucous membrane and to the promontory, on which it anastomoses with a twig of the middle meningeal artery. Frequently also it furnishes another which enters from behind forwards into the Vidian canal (2280).

2286. On emerging from the canal, the internal carotid artery directs itself upwards and a little forwards, enters into the cavernous sinus of the dura mater (1499), and follows anteriorly its lower wall, on the sides of the body of the sphenoid bone, to above the anterior clinoid process, being enveloped by the inner membrane of the sinus and coasted by the external oculo-motor nerve and cavernous ganglion (1803). In this course, the artery forms two curves which pretty exactly resemble those of a Roman S. The convexity of the first is turned backwards and upwards, and that of the second forwards and downwards. While contained in the cavernous sinus, the internal carotid artery sends two or three twigs to the dura mater, the pituitary body, the membrane of the sphenoidal sinuses and the trunks of the common motor, pathetic, trifacial, and external motor nerves.

2287. Arrived under the anterior clinoid process, it curves vertically upwards, then directs itself a little backwards, is embraced by the dura mater (1488) and arachnoid membrane (1516), and enters into the skull a little externally and posteriorly of the optic nerve. It is afterwards enveloped with a sheath which is furnished it by the arachnoid membrane, ascends obliquely backwards and outwards, and separates into several branches opposite the fissura Sylvii (1435), where it terminates. But before this, at the moment when it ascends along the anterior clinoid process, the internal carotid artery furnishes a very remarkable branch, which is the following.

OPHTHALMIC ARTERY.

2288. The *Ophthalmic Artery* (*Artère orbitaire*, Chauss.) is no of large size. Immediately after its commencement, it enters into a small canal which the dura mater presents to it, places itsel without and above the optic nerve, passes along with it through the optic foramen, and enters into the orbit between the externa motor nerve of the eye and the rectus externus muscle. It then ascends on the outer side of the optic nerve, passes above it crossing its direction obliquely from without inwards, being covered by the rectus superior oculi muscle, and becomes horizontal a second time to pass forwards, along the inner edge of the nerve, between the obliquus superior and rectus internus muscles of the eye, as far as the internal angle of the orbit, where it ends by dividing into two branches.

BRANCHES WHICH THE OPHTHALMIC ARTERY GIVES OFF BEFORE ASCENDING UPON THE OPTIC NERVE.

1. OF THE LACHRYMAL ARTERY.

2289. It is one of the larger branches of the ophthalmic artery, from which it separates immediately after its entrance into the orbit, to glide, between the outer wall of that cavity and abductor oculi muscle, as far as the lachrymal gland, into which it enters. At its commencement, it throws some ramifications into the abductor oculi, attollens oculum and depressor oculi muscles, the levator palpebræ superioris, the periosteum of the orbit and the envelopes of the optic nerve. Sometimes it also gives rise to the posterior ethmoidal artery. Close to the lachrymal gland, it furnishes some small twigs to the periosteum and abductor oculi muscle, and gives off a small branch which descends backwards and outwards, and presently bifurcates, so that one of its twigs loses itself in the periosteum of the orbit, while the other passes through the malar bone, arrives in the temporal fossa, and anastomoses with the anterior deep temporal artery (2277).

2290. Arrived at the lachrymal gland, the artery passes above it, or surrounds it with a vascular net-work. In all cases, it sends a great number of twigs into its parenchyma. At the same time there arise from it two twigs, the *External Palpebral*, one of which, the *inferior*, passes under the gland to gain the orbicularis palpebrarum muscle, where it anastomoses by an arch, upon the lower edge of the corresponding tarsal fibro-cartilage, with ramifications of the inferior palpebral and superficial temporal arteries; while the other, or *superior*, passes over the gland, and is distributed in the same manner in the upper eyelid.

2291. Beyond the gland, the lachrymal artery loses itself in minute twigs in the two eyelids and in the tunica conjunctiva.

2292. Sometimes the lachrymal artery comes off from the middle meningeal. In that case, after giving a twig to the dura mater, it enters into the orbit by the sphenoidal fissure.

2. OF THE CENTRAL ARTERY OF THE RETINA

2293. Excessively slender, it comes off from the ophthalmic artery, a little after the preceding, or sometimes comes from one of the ciliary arteries. It perforates obliquely, and at a greater or less distance from the ball of the eye, the envelopes of the optic nerve places itself in its centre, and accompanies it into the eye, where it penetrates sometimes single, sometimes divided into two or three branches. It then sends to the internal lamina of the retina (1903) a multitude of twigs which there form a very apparent net-work, and which may be followed as far as the ciliary body, without its being ascertained whether it passes farther. One of these twigs penetrates into the vitreous body, furnishes it with some ramifications of excessive tenuity, and seems to arrive at the posterior part of the capsule of the crystalline lens.

2294. Pretty frequently other two or three small arteries are observed, which arise from the ophthalmic, and like the central artery, pass into the envelopes of the optic nerve, but without reaching so far as the retina.

BRANCHES WHICH ARISE FROM THE OPHTHALMIC ARTERY DURING ITS PASSAGE ABOVE THE OPTIC NERVE.

1. OF THE SUPRA-ORBITAR OR SUPERCILIARY ARTERY.

2295. It sometimes comes from the lachrymal artery. Its size is moderate. It proceeds from behind forwards, along the uppe wall of the orbit, above the levator palpebræ superioris and attollens oculum muscles, under the periosteum, at the inner side of the frontal nerve (1579). Arrived at the base of the orbit, after furnishing some minute ramifications to the periosteum and the tw muscles above mentioned, it issues from that cavity by the superciliary notch, giving off in its passage a small twig to the diplo of the frontal bone. It then divides into two branches, of whic the *internal*, which is larger, ascends upon the forehead, behin the corrugator supercilii and orbicularis palpebrarum muscles, an separates almost at once into a great number of twigs, which are distributed in a divergent manner in these muscles and in the frontalis anastomosing with those of the frontal and superficial temporal arteries (2264). The other or *external* branch follows nearly th same course; but its twigs extend much farther, and communicat externally with those of the lachrymal artery.

2. OF THE POSTERIOR OR SHORT CILIARY ARTERIES.

2296. The *Posterior Ciliary Arteries* (*Artères uvèales* Chauss.) are very numerous, sometimes amounting to thirty or forty Almost all of them come from the ophthalmic artery; but the lachrymal, posterior ethmoidal, and infra-orbitar or inferior muscula arteries almost always furnish some. They are extremely flexuous and are found immersed in the soft fat which surrounds the opti nerve, upon which they are more or less accurately applied. The give off in general some very slender twigs which dive into th groove which embraces that nerve at the moment when it enters th eye.

These twigs anastomose with each other and there form a very apparent circular net-work, which is joined by some ramifications of the ophthalmic artery.

2297. Arrived at the posterior part of the ball of the eye, these arteries separately penetrate the sclerotica near the entrance of the optic nerve, and sometimes after bifurcating. Some of them remain in that membrane, and there anastomose with the twigs which it receives from the muscular arteries; others supply it alone with very slender ramifications; but the greater number pass between it and the choroid membrane, and divide into a very great quantity of twigs which come off at a very acute angle, and afterwards direct themselves forward, running nearly parallel to each other. All these twigs confine themselves in a great measure to the external surface of the choroid membrane, and form by their subdivisions and numerous anastomoses, a very delicate net-work, of which the areolæ are quadrangular, and much looser before than behind. Some of these twigs communicate with those of the anterior ciliary arteries; others pass through the ciliary body and throw themselves into the great arterial circle of the iris; but almost all go to lose themselves in the ciliary processes, and in so great number, that twenty or thirty are counted for each of these small bodies. They proceed a short way in a tortuous manner in their substance, then unite into twigs progressively larger, which, behind the iris, bend toward each other, and anastomose in the manner of an arch.

3. OF THE LONG CILIARY ARTERIES.

2298. The *Long Ciliary Arteries (Artères iriennes,* Chauss.) are a little larger than the preceding, and are generally two in number, an external and an internal. They pass through the sclerotica at a greater distance from the optic nerve than the posterior ciliary arteries, and, after giving some small twigs to that membrane, proceed horizontally forwards between it and the choroid membrane, to which they distribute very few ramifications, they thus arrive at the ciliary body, where they divide each into two twigs which separate from each other at a very obtuse angle, unite with some small twigs of the anterior ciliary arteries, anastomose together, and form a very apparent vascular circle upon the large circumference of the iris.

2299. From the whole inner side of the circumference of that circle, arise a great number of smaller twigs, each of which presently bifurcates itself, and anastomoses with the neighbouring twigs so as to form a second vascular circle internally of the preceding. From this circle, which is also joined by some ramifications of the anterior ciliary arteries, proceed other twigs, which are extremely numerous, but of the greatest tenuity. These proceed in a serpentine manner, under the form of radii, towards the small circumference of the iris, where they anastomose with each other, so as to form a third circle which embraces the pupil. Some of these twigs do not anastomose however, and go directly to the pupil. In the fœtus, there are seen setting out for the *membrana pupillaris* (1899), about thirty flexuous and radiating ramifications, which leave the concavity of the great arterial circle of the iris to anastomose thousands of times between the two laminæ of the membrane, forming very flexuous arches of variable figure and size, between which there remains towards the centre of the pupil, an empty space of an irregular form, and destitute of blood-vessels.

4. OF THE SUPERIOR MUSCULAR ARTERY.

2300. It is sometimes wanting. Immediately after its commencement, it gains the inferior surface of the attollens oculum muscle, and divides into several twigs which are distributed to its fleshy fibres and to those of the levator palpebræ superioris and obliquus oculi superior muscles, as well as to the periosteum of the orbit.

When this branch does not occur, these twigs arise from the lachrymal artery, the supra-orbitar artery, and the ciliary arteries.

5. OF THE INFERIOR MUSCULAR ARTERY.

2301. More voluminous than the preceding, it is never absent. It arises from the ophthalmic artery between the ciliary arteries, or after the lachrymal, and directs itself from behind forwards between the optic nerve and the depressor oculi muscle. Its twigs are distributed to that muscle, to the abductor oculi, the obliquus oculi inferior, the periosteum of the orbit and the lachrymal sac. It presents the most numerous variations. Its trunk sometimes accompanies the abductor oculi muscle, and issues from the orbit to anastomose by an arch with the infra-orbitar artery. It sometimes gives rise to the central artery of the retina.

2302. From the two muscular arteries principally, and occasionally from the lachrymal and infra-orbitar at the same time come the *Anterior Ciliary Arteries*, which, to the number of four or five, proceed from behind forwards to the anterior part of the ball of the eye, where they divide into several twigs which perforate the sclerotica or are distributed to the tunica conjunctiva. They first enter, therefore, into the eye at the distance of two or three lines from the circumference of the cornea, and lose themselves, for the most part, in the great arterial circle of the iris (2298). Some of them, however, gain the anterior part of the choroid membrane, while others throw themselves into the iris.

BRANCHES WHICH THE OPHTHALMIC ARTERY GIVES OFF IN ITS COURSE ALONG THE INNER SIDE OF THE OPTIC NERVE.

1. OF THE POSTERIOR ETHMOIDAL ARTERY.

2303. This artery is of small size, does not always exist, and occasionally comes from the lachrymal or infra-orbitar. It directs itself towards the inner wall of the orbit, between the obliquus oculi superior and adductor oculi; and enters into the posterior internal orbitar canal. It passes through its whole extent, furnishing very slender twigs to the membrane of the posterior ethmoid cells. It then enters into the skull, and loses itself by subdividing in the portion of the dura mater which lines the anterior middle fossa of the base of that cavity. Some of these twigs communicate with those of the anterior ethmoidal; others penetrate into the nasal fossæ along with the olfactory nerves by the holes of the ethmoid grooves.

2. OF THE ANTERIOR ETHMOIDAL ARTERY.

2304. It separates from the ophthalmic opposite the anterior internal orbitar foramen, into which it penetrates along with the internal nasal nerve (1581). Before entering into the skull, it throws several twigs into the membrane of the frontal sinus and anterior ethmoid cells; and when it has arrived there, it divides into a great number of twigs, of which some ascend upon the falx cerebri, whilst the greater part enter into the nasal fossæ by the holes of the ethmoid bone, and are spread out to a greater or less distance upon the pituitary membrane.

3. OF THE INFERIOR PALPEBRAL ARTERY.

2305. It arises from the ophthalmic a little beyond the cartilaginous pulley of the obliquus oculi superior muscle, and is even sometimes given off by the nasal artery. It descends nearly vertically behind the tendon of the orbicularis palpebrarum, and furnishes at first some twigs to that muscle, the lachrymal sac and the caruncula lachrymalis. It then bifurcates. One of its branches loses itself in the inferior half of the orbicularis palpebrarum, the other directs itself outwards, along the attached edge of the inferior tarsal fibro-cartilage, and is distributed to that cartilage, the Meibomian glands, the tunica conjunctiva and the skin.

4. OF THE SUPERIOR PALPEBRAL ARTERY.

2306. It arises beside and a little before the preceding, and even frequently by a trunk common to both. It sends at first a branch into the upper half of the orbicularis palpebrarum, and some small twigs to the lachrymal sac, the caruncula lachrymalis, and the tunica conjunctiva. It is not rare to see one of the anterior ciliary arteries also separating from it at the same point. It then passes between the fleshy fibres of the muscle, proceeds outwards along the superior tarsal cartilage, and terminates by anastomosing with one of the twigs of the lachrymal artery. In its course, it exhibits precisely the same circumstances as the preceding.

BRANCHES WHICH TERMINATE THE OPHTHALMIC ARTERY.

1. OF THE NASAL ARTERY.

2307. Its volume varies much and is sometimes very large. It issues from the orbit above the tendon of the orbicularis palpebrarum, passes over the side of the root of the nose, and in descending gives some twigs to the lachrymal sac and the neighbouring muscles. It anastomoses more or less low with the last extremity of the facial artery (2137), after forming by its numerous ramifications a very apparent vascular net-work.

2. OF THE FRONTAL ARTERY.

2308. It is smaller than the nasal, and directs itself a little outwards, to issue by the upper and inner part of the orbit. It ascends upon the forehead, between the bone and the orbicularis palpebrarum muscle, and divides at once into two or three branches which become subcutaneous, and subdivide to infinity, and in all kinds of directions, in the orbicularis palpebrarum, frontalis and corrugator supercilii muscles. Its ramifications anastomose with those of the opposite frontal artery and superficial temporal.

2309. After giving rise to the ophthalmic artery, the internal carotid still produces in the interior of the skull several twigs distinguished into posterior and anterior. The first are the communicating and choroidal arteries; the others, the anterior and middle cerebral arteries.

1. OF THE COMMUNICATING ARTERY OF WILLIS.

2310. It directs itself obliquely backwards and a little inwards, passes over the side of the pituitary shaft and mammillary eminences, above the arachnoid membrane, and internally of the thickened edge of the middle lobe of the brain, and goes to open into the posterior cerebral artery, which is furnished by the basilar. Its volume, which is in general rather moderate, frequently varies, however, and is not always the same on both sides.

In its course, it sends very slender ramifications to the optic thalami and nerves, the mammillary eminences, the tuber cinereum (1436), the pituitary shaft, the choroid plexus, and the peduncles of the brain. Frequently the twig which belongs to the optic thalami is much larger than the others.

2. OF THE ARTERY OF THE CHOROID PLEXUS.

2311. Always less than the preceding, it arises above it, and proceeds obliquely backwards and outwards, towards the peduncle of the brain, close to which it enters into the corresponding lateral ventricle by its inferior slit, to lose itself by subdividing in the choroid plexus. But before this it gives a great number of twigs to the thalamus of the optic nerve.

3. OF THE ANTERIOR CEREBRAL ARTERY.

2312. The anterior Cerebral Artery (*Artère lobaire anterieure*, Chauss.) directs itself obliquely forwards and inwards, between the optic nerve and the posterior region of the anterior lobe of the brain, as far as the great slit which separates the hemispheres of that organ from each other. There, after furnishing small twigs to the pia mater and optic and olfactory nerves, it comes very near the corresponding artery of the other side, and unites with it by a very short, but pretty large transverse branch, which is named the *anterior communicating artery*. Sometimes this branch is replaced by three or four parallel twigs; but in all cases, it sends one or more small twigs to be distributed to the fornix, the anterior commissure and the septum of the ventricles.

2313. After thus communicating with each other, the two anterior cerebral arteries change their direction, proceed forwards and dive parallel to each other between the two anterior lobes of the brain, turning over the corresponding extremity of the corpus callosum. They then pass from behind forwards over its upper surface, at the posterior part of which they terminate by subdividing, so as to embrace that body entirely in an arch which exactly represents its form. It is to this arch that the name of *arteria callosa* or *artery of the corpus callosum* is commonly given.

In this second part of its extent, the anterior cerebral artery sends from its concave side a great number of small twigs to the corpus callosum, while, by that which is convex, it furnishes somewhat larger twigs to the plain surface of the cerebral hemispheres. These twigs are lodged and subdivide in the anfractuosities which this surface presents, and are prolonged as far as the convex part of the same hemispheres, where they communicate with those of the middle and posterior cerebral arteries.

4. OF THE MIDDLE CEREBRAL ARTERY.

2314. The *Middle Cerebral Artery (Artère lobaire moyenne,* Chauss.) is much larger than the anterior, it seems to be truly the terminating branch of the internal carotid. Directed outwards and backwards, it gives at first a great number of twigs to the lower part of the brain, to the pia mater which covers its peduncles, and to the choroid plexus. In then enters into the fissura Sylvii; and divides into two large branches which belong, the one to the anterior lobe, the other to the middle lobe of the brain. These branches bend backwards, following deeply the fissure, and end towards the posterior part of the brain, where they subdivide into a great number of twigs. In their course, they also furnish some, and all enter together into the cerebral anfractuosities forming many windings, and ramifying in the pia mater, to such a degree as to convert that membrane into an extremely fine and close vascular net-work, from which issue the arteries which lose themselves in the substance of the brain, and which are truly capillary. It is only in some particular places, which we have already made known, that this organ receives trunks of any size, as in the optic thalami, near the medullary roots of the olfactory nerves, &c.*

OF THE SUB-CLAVIAN ARTERIES.

2315. They are situated upon the posterior part of the thorax and lateral and inferior parts of the neck. At the origin, they present some differences between them which it is of importance to observe.

2316. The right, which is generally a little larger than the left, arises upon the corresponding side of the trachea, and comes from the brachio-cephalic trunk. The left separates from the aorta at the end of its arch: Both extend as far as the upper part of the first rib, in the interval of the scaleni muscles; but the right is obviously shorter than the left. They also differ in respect to their position, direction, and relations to the neighbouring organs.

Thus the right subclavian is more superficial than the left, which appears to depend especially upon the direction of the arch of the aorta. The right directs itself obliquely outwards and upwards as far as the interval of the scaleni muscles; the left ascends vertically to near them; and suddenly turns backwards to penetrate into their interval.

Thus the *anterior side* of the right subclavian is covered, from within outwards, by the clavicle, the sterno-hyoidei and sterno-thyroidei muscles, the corresponding subclavian vein, and the right pneumo-gastric and phrenic nerves, which cross its direction. Its *posterior side* is separated from the vertebral column and longus colli muscle by a pretty large interval. Its *outer side* comes somewhat near the top of the lung, and the *inner* leaves a triangular space between it and the right common carotid artery.

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* It is necessary to study the arteries which are furnished to the brain by the vertebral arteries of the sub-clavian, at the same time that those which the internal carotids transmit to it are examined.

The *anterior side* of the left subclavian is covered at first by the lung and subclavian vein, then by the pneumo-gastric nerve, which instead of crossing its direction, runs parallel to it. Lastly, the first rib, the clavicle and the sterno-thyroideus muscle are applied upon it in a distant manner. Its *posterior side* rests immediately upon the vertebral column and longus colli muscle. Its *outer side* lies upon the pleura, which separates it from the lung; the *inner* runs along the common carotid artery.

2317. The subclavian arteries traverse a considerable space without furnishing any branch; but in the vicinity of the first rib, before passing between the scaleni muscles; they give off a pretty large number, which are distinguished into superior, inferior, and external.

SUPERIOR BRANCHES OF THE SUBCLAVIAN ARTERY.

1. OF THE VERTEBRAL ARTERY.

2318. The *Vertebral Artery* (*Artère cérébrale posterieure,* Chauss.) is the largest branch of the subclavian, almost equalling the axillary artery in size. It is especially destined for the cerebrum, cerebellum and spinal marrow. It arises deeply from the upper and back part of the subclavian, near the place where the latter changes its direction. To the right it forms a very obtuse angle with it, while on the left side it seems to continue it in the same direction.

On both sides, immediately after its commencement, the vertebral artery proceeds directly upwards, behind the inferior thyroid artery, upon the vertebral column, between the longus colli and scalenus anticus muscles. At the end of a more or less short course, it enters the hole with which the base of the transverse process of the sixth cervical vertebra is perforated, and sometimes that of the seventh, without having given rise to any branch. In other rarer cases, it enters these holes only at the fourth or third vertebra. It then ascends in the canal which results from the aggregate of all those holes with which the transverse processes of the cervical vertebræ are perforated, and which is completed by the inter-transversales muscles. In this part of its extent, it passes before the trunks of the cervical nerves. It thus arrives at the axis, having only described very slight flexuosities; but it then leaves the canal, directs itself backwards under the complexus minor, and forms, between the first two vertebræ, a vertical curve, the convexity of which is directed backwards, upwards, and inwards. It then proceeds upwards and outwards as far as the transverse process of the atlas, of which it perforates the base directly upwards, under the obliquus capitis inferior muscle; after which, it passes backwards and inwards, and describes, between that vertebra and the occipital bone, in the triangular space of the recti postici and obliqui capitis muscles, a second transverse curve, whose convexity, also directed upwards, is covered by the complexus major and rectis capitis posticus major muscles, while its concavity embraces the side of the posterior occipito-atloidal ligament (606).

Lastly, the two vertebral arteries pass through the apertures of the two extremities of the same ligament, pass through the dura mater, and introduce themselves into the skull by the occipital foramen, on the sides of the spinal marrow. They then converge and ascend in a tortuous manner inwards and forwards, between the corpora pyramidalia and olivaria (1446) and the basilar groove, on which they unite angularly, to give rise to the basilar artery.

2319. *In the canal of the transverse processes*, the vertebral artery sends off several branches in all directions, of which the external, anterior, and posterior emerge between these processes, go to the intertransversales, scaleni, rectus capitis anticus major, complexus minor, and splenius muscles, and communicate with the neighbouring arteries, while the internal penetrate into the vertebral canal, by the inter-vertebral foramina, to expand upon the spinal marrow and dura mater, anastomosing with those of the opposite side.

2320. *In its vertical curve*, the vertebral artery sends internally and inferiorly of the obliquus capitis inferior a small branch, which bifurcates as it descends. One of its twigs is distributed to the intertransversales cervicis, and the other, (*Rame occipito-meningé*, Chaussier,) ascends under the posterior arch of the atlas to be distributed to the dura mater. Moreover, there also separate from it some twigs for the obliquus capitis inferior and complexus minor.

2321. *In its transverse curve*, it sends a considerable number of twigs to the recti postici and obliqui capitis muscles. One of them, which is larger than the others, is transverse. It directs itself inwards, and presently divides itself into two branches, one o which, anastomosing with that of the opposite side, constitutes a kind of arch between the complexi majores and recti capitis postic majores muscles, while the other, descending obliquely, is distributed to the latter and to the rectus posticus minor.

2322. *Posterior Spinal Artery*, (*Artère mediane postérieur du rachis*, Chauss.) It arises from the vertebral artery, nea the corpora pyramidalia, and sometimes from the inferior cerebellar artery. It directs itself downwards and a little obliquely inwards, passes behind the spinal marrow, and continues to descend parallel to that of the opposite side, as far as the second lumbar vertebra. It is extremely slender. All its twigs are transverse

They anastomose with those of the opposite side, or lose themselves upon the proper membrane of the spinal marrow, sending only some absolutely capillary ramifications to the pulpy membrane of the latter.

2323. *Anterior Spinal Artery*, (*Artère médiane posterieure du rachis*, Chauss.) It is a little larger than the preceding, and arises, internally, near the termination of the vertebral artery. It even sometimes comes from the inferior cerebellar or basilar artery. It descends in a tortuous manner upon the anterior surface of the upper extremity of the spinal marrow, gives some ramifications to it, and unites angularly with that of the opposite side at the level of the occipital foramen. There results from this union a very flexuous common trunk, which descends as far as the lower extremity of the spinal marrow, giving off to the right and left twigs similar to those of the posterior spinal arteries, and which is afterwards prolonged, without dividing, in the midst of the nervous filaments which form the cauda equina, as far as the articulation of the sacrum with the coccyx, where it terminates by anastomosing with the twigs of the lateral sacral arteries.

2324. *Inferior Cerebellar Artery.* It arises externally from the end of the vertebral or even from the basilar trunk. Its size is very variable, although almost always pretty considerable. It directs itself transversely outwards, crossing the corpus pyramidale, passes between the origins of the corresponding pneumo-gastric nerve and the spinal accessory nerve, and advances in a serpentine manner upon the inferior surface of the cerebellum. Its first twigs, which are very small, are distributed to the superior extremity of the spinal marrow, the origins of the pneumo-gastric and hypo-glossal nerves, and the walls of the fourth ventricle. But the last, which are much larger, creep under the hemisphere of the cerebellum, as far as its circumference, where they communicate with those of the superior cerebellar artery. There are only some which penetrate into the anfractuosities; the rest subdivide at the surface, and form a very fine net-work in the pia mater.

2. OF THE BASILAR ARTERY.

2325. The *Basilar Artery* (*Artère mesocephalique*, Chauss.) results from the union of the two vertebral arteries. Larger than either of them individually, it has yet a smaller caliber than that of the two together. It commences posteriorly towards the groove which separates the cerebral protuberance from the medulla oblongata, ascends, describing some flexuosities, in the groove which runs along the middle part of the protuberance, and ends anteriorly in the interval which separates the peduncles of the brain. It therefore corresponds above to a groove of the protuberance, and rests below upon the basilar groove.

2326. In its short course, the basilar artery gives off on each side a great number of small irregular and flexuous twigs, which are distributed to the protuberance, the cerebellum, the corpora olivaria and pyramidalia, and the acoustic, facial and trifacial nerves. But there also separate from it two somewhat more remarkable branches, which are the superior cerebellar.

2327. *Superior Cerebellar Artery.* Arising from the basilar artery, near its termination, it directs itself outwards and backwards under the protuberance and peduncle of the brain, around which it turns to ascend upon the upper surface of the cerebellum, opposite the tubercula quadrigemina, and after sending a great number of twigs over the protuberance, the tubercula quadrigemina, and into the conarium, the choroid plexus and the valvula Vieussenii. It then divides into a great number of more or less considerable branches, some of which ascend in a very flexuous manner upon the posterior lobe of the cerebrum, whilst others descend upon the upper surface of the cerebellum, where they are distributed like those of the inferior cerebellar artery (2324).

2328. The basilar artery terminates by separating into two branches, which are the posterior cerebral arteries.

3. OF THE POSTERIOR CEREBRAL ARTERY.

2329. The *Posterior Cerebral Artery*, (*Art. lobaire posterieure du cerveau*, Chauss.) is much larger than the superior cerebellar, from which it is separated at its commencement by the common motor nerve of the eye (1562). It proceeds at first forwards and outwards, then presently directs itself backwards, turning over the corresponding peduncle of the brain, whence it gains the lower part of the posterior lobe of that organ. Immediately after its commencement, it furnishes several small twigs to the mammillary tubercles, and to the peduncles of the brain. It sends a pretty large one into the third ventricle for the thalamus of the optic nerve, the tuber cinereum, and the anterior pillars of the fornix. Precisely in the place where it is in contact with the common motor nerve of the eye, it receives the communicating artery of Willis, which comes from the internal carotid (2310). Afterwards there still proceed from it a considerable number of twigs for the cerebral protuberance, the peduncle of the brain, the choroid plexus, the thalamus of the optic nerve, the cornu Ammonis, the corpus canaliculatum, the pineal gland and the tubercula quadrigemina.

2330. The branches which this artery sends over the brain dive into the anfractuosities of its posterior lobe, and subdivide in the pia mater like those of the other cerebral arteries, with which besides their ramifications anastomose.

2331. The posterior cerebral arteries, the communicating arteries of Willis, the anterior cerebral, and the anterior communicating artery, form a sort of polygon, in the arch of which are situated the mammillary eminences, the tuber cinereum, the pituitary body, and the shaft of the same name.

2332. It is also to be observed, that the principal trunks of the arteries of the brain occupy the base of that organ, and are placed between it and the bony surfaces, so that the motions of the circulation must necessarily impress them very distinctly upon the brain, which in fact is the case. This impulse is transmitted to it in a uniform manner, on account of the extensive anastomoses of these different trunks. The principal branches of these same trunks are lodged in the fissures and anfractuosities. The twigs subdivide to infinity in the pia mater, and it is in reality only the capillary extremities of the vessels that penetrate into the pulp of the organ.

4. OF THE INFERIOR THYROID ARTERY.

2333. Proportionally larger in children than in adults, it is of much smaller size than the vertebral artery, and is more superficial than it. It arises from the upper part of the subclavian, almost at the same level as the internal mammary, and a little externally of the vertebral. It ascends at first vertically upon the scalenus anticus, and, on arriving before the fifth vertebra, suddenly bends inwards, passes transversely behind the common carotid artery (2225), and goes in a tortuous manner to the thyroid body.

2334. *Internal Branches.* The inferior thyroid artery furnishes some internal branches of small size and indeterminate number. They lose themselves by descending in the longus colli muscle, or are distributed to the œsophagus and trachea, which they accompany as far as the thorax. These latter are expanded upon the origin of the bronchi, and in the surrounding lymphatic ganglia (2159), and anastomose with the bronchial arteries and the upper intercostal.

2335. *External Branches.* The posterior and superior scapular arteries often arise externally from the inferior thyroid; but the latter always furnishes in that direction a certain quantity of small branches, more or less slender, which ascend in the scalenus anticus and longus colli muscles, and another much larger branch which is of constant occurrence, and which is named the ascending cervical artery.

2336. *Ascending Cervical Artery.* It ascends upon the scalenus anticus and longus colli muscles, arrives at the rectus capitis anticus major, furnishes ramifications to both, and sends some, moreover, into the splenius muscle and lymphatic ganglia of the neck. It anastomoses with the vertebral, posterior cervical, and occipital arteries.

2337. Arrived at the lower and outer part of the corresponding lobe of the thyroid body, the inferior thyroid artery divides into two large branches which separate from each other, pass behind the organ, and send it numerous twigs which subdivide in its substance, anastomosing with the opposite inferior thyroid artery and with the two superior thyroids. It also throws itself some very small twigs over the mucous membrane of the trachea.

INFERIOR BRANCHES OF THE SUBCLAVIAN ARTERY.

1. OF THE INTERNAL MAMMARY ARTERY.

2338. The *Internal Mammary Artery, (Artère sous-sternale,* Chauss.) It separates from the subclavian at the same level as the inferior thyroid. Very long, but of moderate thickness, it descends at first a little inwards before the scalenus anticus muscle, and externally of the diaphragmatic nerve. It then dives into the thorax, and places itself beneath the pleura, along the posterior surface of the sterno-costal cartilages and internal intercostal muscles, whose direction it crosses. In descending, it gradually approaches the sternum, places itself between the triangularis sterni and the walls of the thorax, and, towards the xiphoid cartilage, divides into two branches which are prolonged to a greater or less distance into the walls of the abdomen.

2339. Near its origin, the internal mammary artery sends a great number of branches to the thymus gland, the sterno-hyoidei and sterno-thyroidei muscles, and the neighbouring lymphatic ganglia.

2340. *Anterior Mediastinal Artery.* It comes off from the upper part of the mammary artery, and sometimes from the arch of the aorta itself, to descend into the superior separation of the anterior mediastinum. At its commencement, it throws some ramifications upon the portion of the pericardium which surrounds the origin of the aorta, and presently after divides into two branches. One of these branches ascends towards the lower part of the neck, behind the sterno-thyroideus muscle, and loses itself in the parenchyma of the thyroid body, anastomosing with the inferior thyroid arteries. The other, which is larger, continues to descend in the mediastinum, and divides into two twigs which separate from each other, and go to subdivide in one or other pleura, still sending ramifications to the thymus, to the substernal lymphatic ganglia, and to the cellular tissue of the mediastinum.

2341. *Superior Diaphragmatic Artery.* Although of very small size, it always exists, and comes off from the internal mammary artery at the level of the sternum. Directed inwards, backwards and downwards, between the heart and lungs, it exactly accompanies the diaphragmatic nerve, forming several sinuosities. It furnishes some small twigs to the fibrous membrane of the pericardium, among which there is observed one which descends so far as the diaphragm, and these turn backwards to lose itself upon the œsophagus. It also sends some to the diaphragmatic nerve, the thymus gland, the mediastinum, the internal surface of the lung, and the walls of the pulmonary veins. When this artery has arrived at the middle and fore part of the diaphragm, it divides into several branches which are consumed in its fleshy fibres, and anastomose there with the inferior diaphragmatic arteries.

2342. In its passage behind the sterno-costal cartilages, the internal mammary artery gives off on each side branches which are distinguished into internal and external.

2343. *External Branches.* Their number in general equals that of the intercostal spaces to which the artery corresponds. Their volume and length are so much the greater, the lower the intercostal spaces are in which they are examined. They arise at the level of the inferior edge of each cartilage, follow it for some time, and descend afterwards upon the intercostal muscle, in which most of them are entirely lost, communicating with the twigs of the intercostal arteries. There are some, however, which perforate the intercostal muscles, and are distributed to the two pectoral muscles, the mamma and the integuments.

Sometimes each intercostal space contains two of these branches, one of them following the inferior edge of the cartilage, the other the superior.

2344. *Internal Branches.* They are so much the larger the higher they are, which is the reverse of the preceding branches. Their number is the same as theirs. Immediately after their commencement, they throw some transverse twigs into the fibrous tissue which covers the posterior surface of the sternum, and direct themselves to the exterior of the thorax, passing through the intercostal muscles near that bone. They then bend upon themselves, and send twigs in a radiating manner into the pectoralis major, obliquus externus abdominis, rectus abdominis and intercostales interni. They anastomose with the preceding branches, and with the external thoracic branches of the axillary artery. The last of these branches directs itself transversely over the xiphoid cartilage, and anastomoses there by an arch with that of the opposite side, whence it frequently descends between the linea alba and the peritoneum to go to the suspensory ligament of the liver, where it communicates with ramifications of the hepatic artery.

2345. Of the two branches which terminate the internal mammary artery, one is external, the other internal. The *external* descends outwards behind the cartilages of the last ribs, furnishes some twigs to the diaphragm, passes between its insertions, and goes to lose itself in the transversus and obliquus abdominis. It anastomoses with the inferior intercostal, lumbar and circumflex iliac arteries. The *internal* descends behind the rectus muscle, gives it a great number of twigs, and anastomoses towards the umbilicus with the epigastric artery.

2. OF THE SUPERIOR INTERCOSTAL ARTERY.

2346. Its volume and length vary much. Arising from the lower and back part of the subclavian, opposite the deep cervical artery, it descends before the neck of the first rib, externally of the inferior cervical ganglion, and forming some flexuosities. Opposite the lower edge of that rib, it gives off two twigs, the one posterior the other external, and sometimes terminates there. But most commonly it passes before the neck of the second rib, and on arriving at the second intercostal space, furnishes two other twigs. In some subjects it proceeds still lower. In the whole of this course, the superior intercostal artery is covered by the pleura.

2347. Before the first rib, it frequently sends a pretty large twig to the lower part of the scalenus anticus muscle. The *posterior branch* which it furnishes in the first intercostal space is very small; and, after throwing some small twigs over the spinal marrow, by the intervertebral foramen, it emerges posteriorly between the transverse processes and goes to lose itself in the muscles of the back. The *external branch*, which comes off from it at the same point, is distributed to the two intercostal muscles, after furnishing some ramifications to the periosteum of the vertebræ, the œsophagus and bronchi.

2348. In the second intervertebral space, the artery terminates by giving two branches still, which follow precisely the same course as the preceding, and is itself lost in the muscles, or anastomoses widely with the first intercostal artery arising from the aorta.

EXTERNAL BRANCHES OF THE SUBCLAVIAN ARTERY.

1. OF THE TRANSVERSE CERVICAL OR POSTERIOR SCAPULAR ARTERY.

2349. Next to the vertebral, inferior thyroid, and mammary arteries, this is the largest branch of the subclavian. It sometimes arises from the inferior thyroid. Directing itself transversely outwards, it winds along the scaleni muscles above the nerves which form the brachial plexus, in the triangular space which exists between the sterno-cleido-mastoideus and trapezius muscles and the clavicle, where it is covered by the first of these muscles. It then curves back and descends obliquely backwards, under the trapezius and levator anguli scapulæ muscles, changes its direction again, and descends vertically under the rhomboideus muscle, along the posterior edge of the scapula, to terminate by subdividing near its inferior angle.

2350. Near its origin, this artery gives off several branches which ascend vertically to lose themselves in the scaleni muscles, and another larger and more superficial branch. The *Superficial Cervical Artery*, which proceeds in a tortuous manner from within backwards, and goes to be distributed to the splenius and trapezius muscles, the cellular tissue and skin of the inferior and lateral region of the neck. In passing under the levator anguli scapula, it sends upwards a pretty large branch which descends under that muscle as far as the supra-spinatus, and is equally distributed among them, communicating with several branches of the superior scapular artery.

2351. Opposite the rhomboideus muscle, the transverse cervical artery separates into two equal branches, one of which follows the posterior edge of the scapula, and spreads out in the sub-scapularis, serratus magnus, rhomboideus, serratus posticus superior, latissimus dorsi and trapezius muscles, as well as in the integuments of the back; while the other proceeds outwards, under the scapula, and is destined for the serratus magnus and subscapularis alone.

2352. In some subjects the transverse cervical artery comes from the axillary, and then, instead of passing above the nerves of the brachial plexus, it glides in one of the intervals which they leave between them.

2. OF THE SUPRA-SCAPULAR ARTERY.

2353. Less voluminous than the preceding, it pretty frequently arises from it, and still more commonly comes off from the inferior thyroid than from the subclavian itself. Sometimes it has a trunk which is common to it and the transverse cervical or internal mammary artery. In all cases it proceeds in a tortuous manner from within outwards, behind the clavicle and above it, covered by the sterno-cleido-mastoideus, platysma-myoides and trapezius muscles, and arrives at the upper edge of the scapula, following exactly the course of the supra-scapular nerve (1683). On arriving near the supra-spinatus muscle, it passes above the coracoid ligament, dives between the supra-spinatus muscle and the fossa of the same name, directs itself outwards under the arch formed by the clavicle and acromion process united, winds over the edge of the spine of the scapula, and enters into the fossa infra-spinata, between the bone and the infra-spinatus muscle.

2354. In the first part of its course this artery furnishes several twigs to the subclavius and platysma myoides muscles, to the clavicle, the cellular tissue and lymphatic ganglia of the lower part of the neck. Before passing over the coracoid ligament, it sends to the supra-spinatus muscle a pretty large superficial branch, which itself gives twigs to the trapezius muscle and acromio-clavicular articulation. They anastomose with the transverse cervical artery. Lastly, in the fossa infra-spinata the supra-scapular artery anastomoses with the sub-scapular which comes from the axillary artery, and divides into two principal branches, of which one follows the anterior edge of the scapula and belongs to the teres major and latissimus dorsi muscles, while the other proceeds transversely backwards under the spine of the scapula, and throws a multitude of twigs into the infra-spinatus muscle.

3. OF THE POSTERIOR OR DEEP CERVICAL ARTERY.

2355. (*Artère trachelo-cervicale,* Chauss.) It arises from the posterior and deep part of the subclavian, externally of the inferior thyroid, behind the scalenus anticus muscle, and immediately before the transverse processes. It has been seen to come from the inferior thyroid or vertebral artery, or to have a common trunk with the superior intercostal. Immediately after its origin, it ascends obliquely outwards, partly between the two last transverse processes of the neck, after giving small twigs to the scaleni, longus colli and rectus capitis anticus major muscles, directs itself backwards, upwards and inwards, between the complexus major and semi-spinalis colli muscles becomes vertical, and ends by anastomosing, towards the head, with the vertebral and occipital arteries, sending numerous ramifications into the muscles and integuments of the back part of the neck.

OF THE AXILLARY* ARTERY.

2356. It forms the direct continuation of the subclavian. Situated at the superior lateral part of the thorax and in the axilla, it commences in the interval between the two scaleni muscles, and directs itself obliquely downwards and outwards, as far as the level of the inferior edge of the latissimus dorsi muscle, where the brachial artery commences. In this course, it describes a curve of which the convexity is directed outwards and upwards, and the concavity inwards and downwards.

2357. The *anterior side* of the axillary artery is at first covered by the platysma myoides in a small triangular space which is formed by the scalenus anticus muscle, the nerves of the brachial plexus and the clavicle. It is then in relation with the clavicle itself, whose direction it crosses, and with the subclavius muscle. Still lower, the pectoralis major muscle, then the pectoralis minor, and lastly, the tendon of the pectoralis major and the coraco-brachialis and biceps muscles are applied upon it. From the clavicle to the lower part of the axilla, the axillary vein lies upon the artery of the same name.

2358. Its *posterior side* rests internally upon the brachial plexus. At the middle it corresponds to the cellular interval which separates the serratus magnus and subscapularis muscles. Externally it lies upon the teres major and latissimus dorsi.

2359. Its *under* or *inner side* is at first lodged in a more or less deep groove which the upper surface of the rib presents for it. It then corresponds to the first intercostal muscle, the second rib, and the upper digitation of the serratus magnus, from which it is afterwards more or less separated by the brachial plexus, or by cellular tissue and lymphatic ganglia.

2360. Its *upper* or *outer side* is at first covered by the skin, the platysma myoides and a layer of adipose tissue, afterwards by the clavicle and subclavius muscle, and lastly, by the capsule of the shoulder-joint, the subscapularis muscle, and the tendon of the teres major and latissimus dorsi, which separates it from the upper part of the humerus.

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* *Axilla*, the arm-pit.

2361. The axillary vein is always placed before the artery, as we have already said. The brachial plexus is situated behind the latter until near the lower edge of the subscapularis muscle, where the principal branches of this plexus embrace the artery and form for it a kind of sheath (1684).

BRANCHES WHICH THE AXILLARY ARTERY GIVES OFF OPPOSITE THE THORAX.

1. OF THE ACROMIAL ARTERY.

2362. It is of considerable size, and comes off from the fore part of the axillary artery, opposite the upper edge of the pectoralis minor, and frequently by a trunk which is common to it and the superior thoracic. Concealed at its commencement by the pectoralis major, it descends obliquely outwards towards the deltoides muscle, throwing some small twigs into the subclavius, serratus magnus and first intercostal muscle. Arrived at the narrow interval which separates the deltoides from the pectoralis major, it divides into two branches, a superior and an inferior.

2363. *Superior Branch.* It ascends in a tortuous manner in the interval which we have just mentioned, and arrives at the clavicle. There it gives off a transverse twig which is distributed to the skin of the top of the shoulder and upon the deltoides muscle. It then dives under that muscle, and still divides into two twigs, one of which follows the edge of the clavicle to its acromial articulation, while the other, which is larger, forms a net-work upon the fibrous capsule of the shoulder-joint. It anastomoses with the superior scapular artery.

2364. *Inferior Branch.* It follows the course of the cephalic vein between the deltoides and pectoralis major muscles (841), and divides into two twigs which are distributed to each of them, anastomosing with the thoracic and circumflex arteries.

2. OF THE SUPERIOR THORACIC ARTERY.

2365. Most commonly it arises along with the acromial. Its size is variable. It descends obliquely forwards between the pectoralis major and pectoralis minor muscles, to which it is distributed by a great number of twigs, some of which run superficially as far as the mamma. It anastomoses with the intercostal arteries and the internal mammary. In some subjects there are two or three superior thoracic arteries.

3. OF THE INFERIOR OR LONG THORACIC OR EXTERNAL MAMMARY ARTERY.

2366. It sometimes arises along with the superior; but more commonly it comes off from the axillary a little lower than it. It descends at first almost vertically, and only a little from behind forwards on the lateral part of the thorax, between the lower edge of the pectoralis major, which covers it and the serratus magnus on which it lies. It then bends inwards, becomes subcutaneous, and divides into several branches which embrace the mamma.

2367. This artery gives numerous twigs to the pectoralis major, serratus magnus and intercostales muscles, the lymphatic ganglia of the axilla, the integuments and mamma. It anastomoses with the intercostal, internal mammary and superior thoracic arteries.

BRANCHES WHICH THE AXILLARY ARTERY GIVES OFF IN THE AXILLA AND UPPER PART OF THE ARM.

1. OF THE COMMON, OR SUB-SCAPULAR ARTERY.

2368. The *Sub-Scapular Artery (Artère sous-scapulaire,* Chauss.) is of considerable size, and comes off from the lower part of the axillary artery, opposite the lower edge of the tendon of the subscapularis muscle and behind the brachial plexus. Immediately after its origin, it gives off three or four pretty large branches which proceed transversely either to the lymphatic ganglia of the axilla, or to the subscapularis muscle. It then descends obliquely along the lower edge of that muscle, and presently divides into two considerable branches, an inferior and smaller, and a superior and larger.

2369. *Inferior Branch.* It descends upon the subscapularis muscle, and along the anterior edge of the scapula, as far as the lower third of the latter, between the latissimus dorsi and serratus magnus muscles, and in the midst of cellular tissue. It divides into a very great number of twigs, all of large size, which are expanded partly in the middle and inferior portions of the serratus magnus, and partly throw themselves into the latissimus dorsi and integuments of the back. Some of them run along the edge of the scapula and turn over its inferior angle, to anastomose with twigs of the superior branch, and of the transverse cervical artery.

2370. *Superior Branch.* It runs horizontally from before backwards between the latissimus dorsi and subscapularis, teres major and minor, triceps extensor and subscapularis muscles, to turn over the anterior edge of the scapula. At its commencement it gives a remarkable twig to the latissimus dorsi, near its tendon, and throws some small twigs into the subscapularis, teres major and teres minor muscles. After bending over the edge of the scapula, it enters into the fossa infra-spinata, where it divides into two twigs. One of these twigs, which is superficial and smaller, glides between the skin and aponeurosis of the infra-spinatus muscle; while the other, which is deep and much larger, passes under the teres minor and infra-spinatus muscles, and is distributed in their substance by three or four large secondary twigs. One of them ascends under the acromion to enter into the fossa supra-spinata, and goes to anastomose with a branch of the supra-scapular artery.

2. OF THE POSTERIOR CIRCUMFLEX ARTERY.

2371. Less voluminous than the preceding, it arises from the posterior part of the axillary artery, above the head of the humerus, passes between the subscapularis and teres major muscles, and before the long portion of the triceps extensor. It gives them some twigs, then dives under the deltoides, and arrives at the fore and outer part of the humerus. There then come off from it *superior twigs* which ascend to be distributed to the capsule of the shoulder joint, and to the teres minor and infra-spinatus muscles, as well as to the fleshy fibres of the deltoides, between which it anastomoses with the acromial artery; and *inferior twigs*, which descend in the substance of the deltoides as far as its tendon. The artery itself dives into that muscle, and there loses itself by several branches which communicate with those of the anterior circumflex artery.

3. OF THE ANTERIOR CIRCUMFLEX ARTERY.*

2372. It is very small, and is frequently furnished by the preceding. It directs itself horizontally forwards and outwards, under the coraco-brachialis muscle and under the short portion of the biceps flexor, running along the upper edge of the tendon of the latissimus dorsi and teres major muscles. It then turns over the upper part of the humerus, runs between that bone and the deltoides as far as the bicipital groove (442), passes under the tendon of the long portion of the biceps, and dives into the substance of the deltoides where it loses itself. This artery is always immediately applied upon the bone, and adheres to it in a decided manner. It gives but very few twigs to the deltoid muscle until the moment of its termination; but it sends a great number upon the fibrous capsule of the shoulder joint, and upon the subscapularis muscle, near its attachment.

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* M. Chaussier designates the two circumflex arteries by the name, of *scapulo-humerales*.

Pretty frequently, instead of losing itself in the deltoides, the anterior circumflex artery ascends in the bicipital groove and is expanded over the capsule.

OF THE BRACHIAL OR HUMERAL ARTERY.

2373. Placed at the inner and fore part of the arm, from the axilla to a finger's breadth beneath the bend of the humero-cubital articulation, it forms the true continuation of the subclavian and axillary arteries. Pretty deep, and altogether internal above, it becomes more superficial and anterior as it descends.

2374. *Anteriorly*, the brachial artery is successively covered from above downwards, by the coraco-brachialis muscle, which is separated from it by a considerable thickness of cellular tissue, the brachial aponeurosis, and the skin along the inner edge of the biceps muscle, and lastly at the bend of the elbow, by the inferior aponeurosis of the biceps, the median basilic vein and the skin, from which it is separated by a pretty thick layer of cellular tissue.

2375. *Posteriorly*, it is free in its upper third, which is separated from the triceps extensor muscle by a great quantity of fat; but, in the rest of its extent, it is applied upon the brachialis internus muscle.

2376. *Internally*, it is coasted by the brachial vein and median nerve (1693), and covered by the integuments.

2377. *Externally*, it is applied, in its upper third, upon the inner surface of the humerus, from which it is only separated by the lower extremity of the coraco-brachialis muscles. Farther down it is lodged in the groove between the biceps and brachialis internus muscles; and at its lowest part, corresponds to the tendon of the biceps.

2378. The brachial artery gives off a great number of branches, which are distinguished into anterior, posterior, internal and external. Inferiorly, it bifurcates and gives rise to the radial and ulnar arteries.

OF THE ANTERIOR BRANCHES OF THE BRACHIAL ARTERY.

2379. They are all distributed to the biceps flexor or the integuments. They are in general very slender, and their number is indeterminate, as well as their place of origin and their disposition. Most commonly however there are two constant branches towards the upper third of the arm, which descend forwards in the substance of the biceps muscle, and subdivide as far as its lower part.

OF THE POSTERIOR BRANCHES OF THE BRACHIAL ARTERY.

2380. Very short and slender, and irregular as to number, they dive immediately after their origin into the brachialis internus muscle, subdividing there into radiating twigs. Some are seen which proceed downwards as far as the tendon of the muscle, and then change their direction to enter into the biceps ; others bend upwards, and send some ramifications as far as the deltoid muscle.

OF THE EXTERNAL BRANCHES OF THE BRACHIAL ARTERY.

2381. They are small and few in number. They divide into the coraco-brachialis muscles, or pass between the brachialis internus and biceps to be distributed to the integuments.

OF THE INTERNAL BRANCHES OF THE BRACHIAL ARTERY.

1. OF THE SUPERFICIAL AND SUPERIOR INTERNAL BRANCHES.

2382. Their number is indeterminate, although always considerable. Some of them ascend towards the fore part of the axilla, and spread out anteriorly upon the pectoralis major, and externally upon the deltoides, anastomosing with the thoracic and circumflex arteries. Others direct themselves transversely inwards and backwards, along the long portion of the triceps extensor, in which they descend to a greater or less extent, ramifying much. Lastly, there are some which arise lower and descend, some backwards in the long portion of the same muscle, the others forwards in its inner portion. Among these latter there is commonly one which follows the ulnar nerve to the lower part of the arm, where it anastomoses near the inner condyle with the twigs of the inferior internal branch.

2. OF THE DEEP HUMERAL OR EXTERNAL COLLATERAL ARTERY.

2383. (*Artère grande musculaire du bras*, Chauss.) It is always of considerable size, but does not always come from the brachial artery, being sometimes given off by the posterior circumflex, sometimes by the common scapular. When it is furnished by the brachial artery, it separates from it above the inner portion of the triceps extensor muscle and at the level of the groove of the humerus in which the musculo-spiral or radial nerve winds. It follows the course of that nerve exactly, and is placed above it (1706). It therefore passes at first between the triceps extensor and the humerus, directing itself backwards and downwards, and when it has arrived at the middle of the posterior surface of the arm, enters between the triceps extensor and brachialis internus, emerges through the interval which separates them, and becomes superficial. It then descends vertically, and at a greater or less distance from the shoulder joint separates into two branches.

2384. Near its origin, the deep humeral artery gives off *posterior twigs* which descend to a greater or less distance in the triceps extensor muscle, and of which one follows its inner portion to near the olecranon. At the same point there also separate from it *external branches* which direct themselves into the outer portion of the muscle, the brachialis internus, and over the periosteum of the humerus. One of them introduces itself into that bone by its nutritious canal, and is distributed to its medullary membrane.

2385. Two branches terminate this artery; one of them follows its original direction and loses itself in the triceps extensor muscle, near its insertion into the olecranon. The other directs itself between the brachialis internus and the integuments, and gives a great number of ramifications to them as well as to the upper part of the supinator longus.

2386. In many cases, the trunk itself of the deep humeral artery anastomoses a little above the outer condyle with a branch given off farther down, and with which it forms a transverse arch, which embraces the humerus externally. The twigs which issue from this arch are diffused over the elbow joint and the origins of the extensor muscles of the hand.

3. OF THE RAMUS ANASTOMOTICUS MAGNUS OR INTERNAL AND INFERIOR BRANCH.

2387. (*Artère collaterale du coude*, Chauss.) It arises from the brachial, very near the inner condyle, and directs itself transversely inwards, before the brachialis internus muscle and behind the median nerve, whose direction it crosses. It passes through the aponeurosis placed between the brachialis internus and the inner edge of the triceps extensor, and there divides into two twigs. One of them follows the edge of the humerus as far as the inner condyle, on which it subdivides, and where it communicates with the anterior ulnar recurrent artery. It sends off a secondary twig which descends upon the fore-arm, between the olecranon and inner condyle, and accompanies the ulnar nerve to a certain distance. The other passes backwards into the olecranal cavity, subdivides and throws itself into the lower parts of the triceps muscle. It anastomoses with the posterior ulnar recurrent artery. The ramus anastomoticus magnus moreover furnishes many small twigs to the brachialis internus and pronator teres muscles, the elbow joint, the integuments, and the ulnar nerve.

A second anastomosing artery is frequently met with.

BRANCHES BY WHICH THE BRACHIAL ARTERY TERMINATES.

2388. They are two in number, the ulnar artery and the radial artery, and separate from each other at an acute angle, under the bend of the arm, and at the place where the tendon of the biceps flexor dives between the anterior muscles of the fore-arm. This division of the brachial artery is not always situated at the same point, and not unfrequently takes place about the middle of the arm, and even sometimes in the axilla. Before furnishing the radial and ulnar arteries, this trunk sends in all cases some isolated and small twigs into the bundle of muscles which are attached to the inner condyle.

OF THE RADIAL ARTERY.

2389. More superficial and smaller than the ulnar, it follows the original direction of the brachial artery, and extends at the fore and outer part of the fore-arm, from the bend of the elbow to the wrist joint, where it winds outwards, and dives under the tendons of the extensor muscles of the thumb, to place itself in the interval of the first two metacarpal bones. From thence it descends between the second of these bones and the abductor indicis (1245), and passes into the palm of the hand, where it constitutes the deep palmar arch.

1. OF THE RADIAL ARTERY IN THE FORE-ARM.

2390. Before the radial artery arrives at the wrist, it has the following relations to the neighbouring parts.

1. *Posteriorly*, it is applied upon the anterior surface of the radius, from which it is separated above by fat and by the supinator brevis, in the middle by the pronator teres, farther down by the flexor longus pollicis, and still lower by the pronator quadratus muscle, under which it rests immediately upon the bone.

2. *Anteriorly*, it is covered by the radial vein, in its whole extent, and in its two upper thirds by much adipose tissue, and by the supinator radii longus; but below, it becomes subcutaneous, and its pulsations may be very distinctly felt through the skin during life.

3. *Internally*, it is applied against the pronator teres above, the flexor carpi radialis at the middle, and flexor digitorum sublimis below.

4. *Externally*, it corresponds only to the supinator longus and the radial nerve.

2391. The branches which the radial artery gives to the fore-arm are distinguished into anterior, posterior, external and internal.

2392. *Anterior Branches.* Their number is as uncertain as their disposition. They pass through the aponeurosis and are distributed to the integuments of the fore-arm.

2393. *Posterior Branches.* They are very slender, and descend obliquely towards the flexor longus pollicis and pronator quadratus, in which they are lost.

2394. *External Branches.* The largest of these branches separates from the radial artery at the moment of its commencement. It is named the *Radial Recurrent (Récurrente de l'epicondyle,* Chauss.) Directing itself at first transversely towards the supinator longus, it presently bends to ascend between it, the supinator brevis and brachialis internus muscles, to the neighbourhood of the olecranon. It thus forms a kind of arch, from the convexity of which proceed several twigs which descend between the two supinator muscles, to which they are distributed, as well as to the two extensores carpi radiales, the extensor digitorum communis, and the extensor muscles of the thumb. In terminating, this artery divides into several other twigs which anastomose with those of the deep humeral artery (2383).

The other external branches are numerous, but their occurrence is not always regular. They descend obliquely in the supinator longus and extensores carpi radiales, as well as in the extensor ossis metacarpi pollicis.

2395. *Internal Branches.* Very numerous, but very irregular, they are distributed in the muscles of the anterior and superficial layer of the fore-arm. Two of them however are constant, and arise from the radial artery, close to the wrist. The first, which is very small and very deep, directs itself transversely inwards, along the inferior edge of the pronator quadratus muscle, and anastomoses with a similar branch of the ulnar artery, forming an arch which furnishes twigs above for the pronator quadratus and below for the ligaments of the wrist.

2396. The second branch which is called superficialis volæ, *(Artère radio-palmaire,* Chauss.) is superficial. It varies much as to size. It descends obliquely before the anterior annular ligament of the wrist, and gains the palm of the hand, after passing through the upper extremity of the abductor brevis pollicis. It anastomoses with the extremity of the superficial palmar arch formed by the ulnar artery, and sends a great number of twigs to the muscles and integuments of the external palmar region.

2. OF THE RADIAL ARTERY BEHIND THE WRIST.

2397. It is only covered, in this region, by the tendons of the abductor longus and extensores pollicis, and by the integuments. It is applied upon the ligaments of the carpus, and upon the upper part of the first metacarpal bone. The branches which here come off from it are distinguished into internal and external.

2398. *External Branches.* They are three in number, and are distributed to the thumb. The first descends under the tendons of the abductor longus and extensor brevis pollicis, and goes to the attachment of the abductor pollicis, where it loses itself. The second, which arises a little lower, is called the *Dorsal Artery of the Thumb.* (*Artère sus-métacarpienne du pouce*, Chauss.) It descends obliquely outwards, behind the first metacarpal bone and over the first phalanx of the thumb, and terminates by anastomising with its external collateral artery, after distributing some very small twigs to the periosteum, the integuments and the abductor muscle of the thumb. The third descends along with the tendon of the extensor secundi internodii pollicis, upon the inner edge of the first metacarpal bone. It gives ramifications to the periosteum and abductor muscle of the fore-finger.

2399. *Internal Branches.* They are two in number. One belongs to the carpus, the other to the metacarpus.

1. *Dorsal Artery of the Carpus.* (*Art. sus-carpienne*, Chauss.) It arises opposite the outer edge of the tendon of the extensor carpi radialis longior, and directs itself transversely inwards over the posterior surface of the second row of carpal bones, covered by the tendons of the extensores carpi radiales and extensores digitorum, and terminates by anastomosing with a similar branch of the ulnar artery, or by dividing into several twigs. But, in its course, it gives off very short *superior twigs*, which lose themselves upon the ligaments of the radio-carpal articulation, and communicate with those of the anterior interosseous artery, and longer *inferior twigs*, in indeterminate number, which descend towards the superior extremities of the metacarpal bones, where they anastomose with the perforating arteries of the deep palmar arch. They then proceed behind the interossei muscles, and lose themselves in their substance and in the integuments of the back of the hand.

2. *Dorsal Artery of the Metacarpus.* It comes off from the radial artery at the moment when it is about to enter into the upper extremity of the abductor indicis muscle. It passes immediately over the second matacarpal bone, along which it descends obliquely to the middle of the back of the hand. Sometimes it is prolonged as far as the index. Its twigs are distributed to the abductor indicis and integuments. Some of these communicate with the dorsal artery of the wrist.

3. OF THE RADIAL ARTERY IN THE PALM OF THE HAND.

2400. On entering into the palm of the hand, the radial artery separates into two large branches. One of them descends between the flexor brevis pollicis and abductor indicis muscles, and divides into two twigs, one of which follows the inner edge of the thumb, the other the outer edge of the fore-finger, at the extremities of which they anastomose with the collateral vessels.

2401. *Deep Palmar Arch.* It is formed by the second branch of the radial artery, which passes transversely to near the rin finger, describing a slight curve having its convexity directed downwards. It is covered by the adductor pollicis, the tendons o the two flexor muscles of the fingers, and the lumbricales, and rest upon the extremities of the metacarpal bones and upon the interossei muscles.

The twigs which it furnishes are superior, inferior, anterior and posterior.

2402. *Superior Twigs.* They are very slender and not numerous. They ascend before the carpus and are distributed to its ligaments and to the adductor, flexor brevis and opponens pollicis muscles.

2403. *Inferior Twigs.* More voluminous and longer, they are generally five in number. The first four descend in the interosseal spaces, from the second to the fourth, and arrive at the articulation of the metacarpal bones with the fingers, where they divide into several small twigs which are distributed upon the fingers. The fifth is a little inclined downwards, and passes between the flexor brevis and opponens minimi digiti, in which it loses itself.

2404. *Anterior Twigs.* Very short and small, they are entirely destined for the lumbricales muscles.

2405. *Posterior Twigs or Perforating Arteries.* They are three in number. At the commencement, they pass through the corresponding interossei muscles, and go to anastomose on the back of the hand, with the twigs of the dorsal artery of the wrist (2393).

2406. The deep palmar arch terminates, toward the inner edge of the hand, by anastomosing with a branch of the ulnar artery under the flexor brevis and opponens pollicis muscles.

OF THE ULNAR ARTERY.

2407. The *Ulnar Artery* is larger than the radial, and descend at the anterior and inner part of the fore-arm, from the bend o the arm to the palm of the hand. It is at first directed a little obliquely inwards, and enters between two layers of the anterior muscles of the fore-arm, whose direction it slightly crosses. A the middle part of the fore-arm, it becomes vertical and emerge from beneath the muscles, in the place where the flexor digitorum sublimis muscle separates from the flexor carpi ulnaris. It preserve its direction as far as the pisiform bone, where it is nearly as superficial as the radial artery. It then bends outwards, passes ove the anterior annular ligament of the wrist, and forms in the palm of the hand the superficial palmar arch.

The ulnar artery, in this course, is a little flexuous. Its upper part describes a slight curve, of which the convexity is directed inwards and backwards.

2408. Its *anterior side* is covered above, at first by the median nerve, afterwards by the pronator teres, flexor carpi radialis, flexor digitorum sublimis and flexor carpi ulnaris muscles. Inferiorly, it is in relation with the aponeurosis and skin, from which it is separated only by the lateral projections of the flexor sublimis and flexor carpi ulnaris. In the hand, it is entirely concealed beneath the palmaris brevis and palmar aponeurosis.

2409. Its *posterior side* is applied, from above downwards, upon the brachialis internus, flexor digitorum sublimis and pronator quadratus muscles, the anterior annular ligament of the wrist, and the tendons of the two flexor muscles of the fingers.

2410. Its *inner side* is coasted by the ulnar nerve and flexor carpi ulnaris muscle. It corresponds below to the pisiform bone.

2411. Its *outer side* is applied upon the flexor digitorum sublimis.

2412. *Anterior Ulnar Recurrent Artery, (Recurrente de l'epitroklée*, Chauss.) It arises from the inner side of the ulnar artery, at the moment of its commencement, and descends at first a little outwards between the brachialis internus and pronator quadratus and flexor carpi radialis muscles. It then ascends towards the fore part of the inner condyle, where it anastomoses with the ramus anastomoticus (2387). It is of small size, and gives twigs to the pronator teres, flexor carpi radialis and flexor digitorum sublimis muscles, the periosteum of the humerus and the integuments.

2413. In the fore-arm, the ulnar artery gives off branches which are distinguished into internal, external, anterior and posterior.

2414. *Internal Branches.* The largest and most constant is the *Posterior Ulnar Recurrent Artery, (Recurrente de l'epitroklée*, Chauss.) which much exceeds the anterior in size, and comes off from the ulnar artery a little lower than it. It descends at first inwards, behind the pronator teres, flexor carpi radialis and flexor digitorum sublimis, and before the flexor digitorum profundus. It then ascends behind the inner condyle, between that eminence and the olecranon, beside the ulnar nerve, passes between the two origins of the flexor carpi ulnaris (1166), and anastomoses with the deep humeral (2383) and the ramus anastomoticus (2387). It gives off a great number of twigs which are distributed to the flexor muscles of the fingers, flexor carpi ulnaris, and triceps extensor muscles, to the ulnar nerve and the integuments.

2415. Nothing can be less regular as to number and disposition than the other internal branches. One of them however, which is somewhat larger than the rest, separates from the ulnar artery at its lowest part, and goes to unite with the dorsal artery of the carpus or to lose itself upon the corresponding edge of the hand.

2416. *External Branches.* Very numerous and small, they almost all throw themselves into the flexor digitorum sublimis and flexor carpi ulnaris. One of them however is constant in its occurrence. It follows the inferior edge of the pronator quadratus, and goes to communicate with a similar branch of the radial artery (2395).

2417. *Anterior Branches.* They are very numerous, and ar all distributed to the superficial and anterior muscles of the fore arm. One of them only, which is longer and larger than th others, and sometimes arises from the interosseous artery, descend behind the median nerve as far as the lower part of the fore-arm and gives off laterally a great number of small twigs to the flexo digitorum sublimis.

2418. *Posterior Branch* or *Interosseous Artery.* It come from the posterior part of the ulnar, a little beneath the bicipita tuberosity of the radius, and is always of considerable size. It directs itself horizontally backwards, and almost immediately divide into two branches which are named the anterior and posterior interosseous.

2419. *Anterior Interosseous Artery.* It descends verticall before the interosseous ligament, between the flexor longus pollici and flexor digitorum profundus muscles, which conceal it by thei approximation. Arrived at the upper edge of the pronator quadratus muscle, where its size is already sensibly diminished, i passes behind it, perforates the interosseous ligament near the inferior articulation of the radius and ulna, descends in the groov which lodges the tendons of the extensor digitorum communi muscle, passes over the carpus, and then divides, anastomosing with the dorsal artery of that part.

In its course the anterior interosseous artery gives off on eac side numerous twigs, which direct themselves transversely or descend obliquely in the flexor longus pollicis and flexor digitorum sublimis. Anteriorly and inferiorly, there also separate from i some twigs for the pronator quadratus muscle. Those which com off posteriorly pass through the interosseous ligament, and go t lose themselves in the posterior and deep muscles of the fore-arm or to anastomose with the branches of the posterior interosseou artery.

2420. *Posterior Interosseous Artery.* It passes above the interosseous ligament, and appears at the posterior and upper part o the fore-arm, under the anconeus muscle, where it divides into tw branches of nearly equal size.

1. One of these, named the *Posterior Radial Recurrent Artery* (*Recurrente olécrânienne*, Chauss.) ascends between the anconeu and extensor carpi ulnaris muscles as far as the back part of th outer condyle, where it anastomoses with the twigs of the deep humeral artery (2387) and radial recurrent (2394). It distribute its divisions to the extensor carpi ulnaris, anconeus and triceps extensor muscles, the elbow joint, and to the periosteum of the humerus and bones of the fore-arm.

2. The other branch, or *Posterior Interosseous Artery*, properly so called, descends vertically between the supinator brevis and extensor ossis metacarpi pollicis muscles, and afterwards between the two layers of the posterior muscles of the fore-arm, as far as the posterior surface of the carpus, where it anastomoses with the an-

terior interosseous. It becomes much smaller inferiorly, and gives a great number of ramifications to the extensor carpi ulnaris, extensor proprius minimi digiti, extensor digitorum communis, extensores carpi radiales, supinator brevis, extensor ossis metacarpi pollicis, extensor primi internodii and extensor secundi internodii pollicis, and extensor indicis. One of its twigs, which is much larger than the rest, passes between the extensor ossis metacarpi pollicis, and extensor primi internodii pollicis, gains the inferior extremity of the radius, and loses itself separately at the posterior and external part of the carpus.

2421. *Superficial Palmar Arch.* When the ulnar artery has passed the pisiform bone, it descends at first vertically before the anterior annular ligament of the wrist, then bends outwards in the palm of the hand, to form this arch, of which the convexity is directed downwards. Towards the upper extremity of the second metacarpal bone, it dives to communicate with a branch of the radial artery.

The concavity of this arch gives off but very few twigs, which are distributed to the lumbricales muscles and annular ligaments. But its convexity generally furnishes five larger branches, which are called the *Collateral Arteries of the fingers.*

The first of these collateral arteries descends obliquely inwards upon the muscles of the little finger, to which it gives ramifications, and whose direction it crosses at right angles. It is afterwards placed upon the inner edge of the little finger, and reaches as far as its extremity.

The other four branches descend in the interosseous spaces to the heads of the metacarpal bones, where they divide each into two twigs, which run along the corresponding edges of the four fingers and the inner edge of the thumb. They anastomose by an arch with each other, in the substance of the pulp of the fingers, and give off in their course a great number of twigs, which are distributed to the tendons and sheaths of the flexor muscles, the periosteum of the phalanges, the ligaments by which they are united, and especially to the integuments.

OF THE ARTERIES WHICH ARISE FROM THE THORACIC AORTA.

2422. They are distinguished into those which come from its anterior part and those which issue from its sides.

BRANCHES WHICH THE THORACIC AORTA FURNISHES ANTERIORLY.

a. OF THE BRONCHIAL ARTERIES.

2423. There are commonly two, a right and a left. The *right* arises from the aorta itself, or, which is more common, from the first intercostal artery. Sometimes it is the internal mammary artery that furnishes it. At the moment of its commencement, i throws some twigs over the œsophagus. It then advances in a tortuous manner along the posterior part of the bronchus of its side, and sends some slight ramifications over the pleura, pericardium, and bronchial lymphatic ganglia.

2424. The *left bronchial artery* arises from the aorta, at th same level as the right, gives small twigs to the same parts, proceeds behind the left bronchus, and arrives at the corresponding lung.

2425. Frequently the two bronchial arteries come from a common trunk. Sometimes there are four of them, two for the righ lung and two for the left. They present a multitude of variations but in all cases where they have arrived at the entrance of th bronchi into the lungs, the right commonly separates into five twigs, and the left into four. These twigs plunge into the parenchyma of the organ, along with those of the bronchi, and subdivide precisely like them, in such a manner, however, that eac bronchial twig is accompanied by two or three very flexuous arteria twigs, frequently anastomosing together. There results a ver fine net-work, which is especially distributed to the bronchi, although some ramifications also go to the parenchyma of the lun and the walls of the pulmonary arteries and veins.

The bronchial arteries communicate with the other vessels whic enter into the composition of the lungs.

b. OF THE ŒSOPHAGEAL ARTERIES.

2426. Their number varies from two to five or six, and thei size equals that of the bronchial. They arise from the fore part o the aorta, and give off at first some twigs to the pleuræ, and to th cellular tissue of the posterior mediastinum. Almost immediatel after their commencement, they bend to the right and downward and ramify in the substance of the walls of the œsophagus. Th lowest anastomoses with branches of the coronary artery of the stomach.

c. OF THE POSTERIOR MEDIASTINAL ARTERIES.

2427. They are extremely numerous and very slender. The come from the fore part of the aorta, and from the œsophageal an intercostal arteries, and are distributed to the cellular tissue of th posterior mediastinum and to the walls of the aorta, where the form a very elegant net-work. Some of them anastomose by a arch with the thymic twigs of the internal mammary artery.

BRANCHES WHICH THE THORACIC AORTA FURNISHES LATERALLY.

OF THE INFERIOR OR AORTIC INTERCOSTAL ARTERIES.

2428. Their number is commonly nine on each side; but it is sometimes eight or ten, according to that of the intercostal spaces to which the superior intercostal artery gives twigs (2346). They arise from the lateral and posterior parts of the aorta at a slightly acute angle, and immediately ascend obliquely outwards, before the vertebral column. This inclination upwards is always much greater in the upper than in the lower intercostals.

2429. The right intercostal arteries are longer than the left by the whole breadth of the œsophagus, under which they pass; in other respects, however, they are precisely the same on both sides. The first are lodged in the groove which each body of the vertebræ presents as far as the articulation of the rib with the spine, and are covered by the œsophagus and vena azygos, the direction of which they cross. The second are in relation with the vertebra only in a much smaller space, and are only covered, in this first part of their course, by the pleura and thoracic ganglia.

2430. Near the articulations of the vertebræ with the ribs, on entering each space to which it is to belong, each intercostal artery divides into two branches.

2431. *Dorsal Branch.* It directs itself backwards between the transverse processes of the corresponding vertebræ, internally of the inferior costo-transverse ligament. It furnishes at first some small twigs to the periosteum of the vertebræ, together with small branches which anastomose by arch, upwards and downwards, with the nearest intercostals. Then, through the intervertebral hole it sends off another twig which is distributed to the spinal marrow and its envelopes. Lastly, it traverses the fleshy bundles of the transverso-spinales muscles, descends between them and the longissimus dorsi, and loses itself in the latter and sacro-lumbalis muscle, sending some twigs to the skin.

2432. *Intercostal Branch properly so called.* This, which is much larger than the preceding, may be considered as the continuation of the artery itself. It proceeds, winding a little, to the middle of the intercostal space, between the pleura and external intercostal muscles, and in the midst of much adipose cellular tissue. Immediately after it divides into two twigs which enter between the two planes of the intercostal muscles.

2433. *Inferior Twig.* It is of rather small size, and follows at first for some time the upper edge of the rib which is beneath, and then directs itself upon its outer surface to subdivide in the periosteum.

2434. *Superior Twig.* It is much larger, and runs along the lower edge of the rib which is above, situated in the groove which that edge presents (88). Towards the anterior third of the rib, it leaves that groove and the bone, and directs itself to the middle of the intercostal space. There, as in the rest of its course, it gives numerous twigs to the intercostal muscles, the periosteum of the ribs and the pleura. Some of them pass outwards to the superficial muscles, while others anastomose with the divisions of the inferior twig. Lastly, the branch itself terminates towards the fore part of the thorax, by anastomosing with the branches of the internal mammary artery (2343), if it belongs to one of the intervals which separate the true ribs. If, on the contrary, it occurs in the region of the false ribs, it disperses itself in the muscles of the abdomen, where it anastomoses with ramifications of the internal mammary, epigastric and iliac circumflex arteries.

2435. The last intercostal artery is concealed at its origin by the corresponding pillar of the diaphragm, which receives some twigs from it. After supplying its dorsal branch, it continues its course along the inferior edge of the rib which is above, and arriving at its middle part, divides into two or three branches. One of them passes transversely into the abdominal muscles; the others descend vertically, between the two oblique muscles of the abdomen, as far as the iliac crest, where they anastomose with the lumbar arteries, or with the circumflex iliac artery.

OF THE ARTERIES WHICH ARISE FROM THE ABDOMINAL AORTA.

2436. These are distinguished into anterior, lateral, and inferior.

BRANCHES GIVEN OFF ANTERIORLY BY THE ABDOMINAL AORTA.

a. OF THE RIGHT INFERIOR DIAPHRAGMATIC ARTERY.

(*Artère Sous diaphragmatique*, Chauss.)

2437. It generally comes off from the aorta by itself, sometimes along with the left. It also occasionally comes from the cœliac artery. In the first case, it has its origin immediately beneath the interlacing of the fleshy fibres which go from one pillar of the diaphragm to that of the opposite side. It immediately ascends a little outwards, along the free edge of the right pillar of that muscle, to which it gives several twigs, as well as to the supra-renal capsule, the pancreas and the liver. It then divides into two branches.

2438. *Anterior Branch.* It gives off at its commencement a transverse twig, which unites before the œsophagus with a similar twig of the left diaphragmatic artery. It then traverses the adhesion of the liver to the diaphragm, gains the neighbourhood of the vena cava inferior, sends several ramifications to the pericardium, through the diaphragm, and separates into a great number of secondary branches which lose themselves in that muscle, communicating with the corresponding superior diaphragmatic. Others penetrate into the liver by its most retired part. One of them, which seems to be the continuation of the original trunk; turns over the central aponeurosis, and anastomoses with the left diaphragmatic.

2439. *External Branch.* Directed transversely outwards, above the liver, behind the right lobe of the aponeurosis of the diaphragm, it terminates in the digitations by which the diaphragm is attached to the ribs. It furnishes two or three twigs to the renal capsule, and by those which are diffused in the muscle it anastomoses with the other branch, and with the inferior intercostal and lumbar arteries.

b. OF THE LEFT INFERIOR DIAPHRAGMATIC ARTERY.

2440. Arising at the same point as the preceding, it ascends outwards, before the left pillar of the diaphragm, to which it furnishes some twigs. It also sends one of somewhat larger size over the œsophagus, which ascends upon that canal into the thorax, and communicates with one of the œsophageal arteries. It also gives three or four small branches to the left renal capsule, and reaches the aponeurosis of the diaphragm, where it divides into two branches, above the œsophageal aperture of the diaphragm.

2441. *Anterior Branch.* Directed obliquely from behind forwards, it gains the anterior region of the muscle, after giving off a twig which anastomoses with the opposite artery at the fore part of the œsophagus (2438). On the diaphragm itself, it separates into a great number of secondary branches. One of them directs itself to the right, and communicates, as we have said, behind the aponeurosis of the diaphragm, with the opposite artery. The others are distributed precisely as on the right side.

2442. *External Branch.* It is larger. Directed transversely behind the left lobe of the phrenic aponeurosis, it ramifies in the fleshy fibres of the muscle, and anastomoses with the anterior branch, the last intercostal and the lumbar arteries. Some of its ramifications go to the spleen.

c. OF THE CŒLIAC[*] ARTERY.

2443. The *Cœliac (Art. Opisto-gastrique,* Chauss.) is the shortest of the arteries which the abdominal aorta furnishes. It comes off at a right angle, between the crura of the diaphragm, opposite the union of the last vertebra of the back with the first of the loins. It is directed horizontally forwards and to the right, in the posterior separation of the two laminæ of the hepato-gastric omentum. It corresponds, *above,* to the left side of the small lobe of the liver; *below,* to the upper edge of the pancreas, on which it rests; *to the left,* to the cardia; *to the right,* to a pretty considerable space which separates it from the pylorus.

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[*] *Κοιλία, venter, ventriculus.*

2444. This artery sometimes furnishes the capsular or the inferior diaphragmatic. But it always separates, after a course of about half an inch, into three branches of unequal size, which are named the coronary artery of the stomach, the hepatic artery, and the splenic artery.

OF THE CORONARY ARTERY OF THE STOMACH.

(*Art. Coronaria ventriculi*, Soemm. *Art. Stomo-gastrique*, Chauss.)

2445. This is the smallest of the three which arise from the cœliac trunk. It directs itself upwards, forwards, and to the left, approaching the cardia, over the right side of which it bends downwards to follow the small curve of the stomach, to near the pylorus, where it anastomoses with the pyloric artery. In this second part of its course, it occupies the interval which the two laminæ of the hepato-gastric omentum leave between them, at the moment when they go to cover the stomach (2087). The branches which it gives off may be distinguished into œsophageal and gastric.

2446. *Œsophageal Branches.* They vary in number, and are either vertical or transverse. Frequently there is only one of the former. Arising from the bend which the artery forms near the cardia, it ascends upon the œsophagus, which it follows to a considerable distance in the posterior mediastinum, and is distributed to its walls by a great number of flexuous twigs, which anastomose with the aortic œsophageal arteries (2426). If there be two or a greater number, they follow precisely the same course.

The transverse branches surround the cardia in a semicircular manner. Some of them subdivide on the widest part of the œsophagus; the others extend as far as the great cul-de-sac of the stomach, and there anastomose with the vasa brevia.

2447. *Gastric Branches.* They come off along the small curvature of the stomach, and pass over the two surfaces of the viscus. Their number is irregular, and their size very variable. They separate into a great quantity of flexuous twigs, which dive between the muscular and mucous coats of the stomach, and anastomose with each other, and with the two gastro-epiploic arteries.

2448. In many subjects, the coronary artery of the stomach sends a very considerable branch to the liver.

OF THE HEPATIC ARTERY.

2449. Much larger than the preceding, it directs itself transversely to the right and forwards under the small lobe of the liver to near the pylorus, whence it slightly ascends towards the neck of the gall-bladder, and the transverse fissure of the liver. In this course, it furnishes only two branches, the pyloric and right gastro-epiploic.

2450. *Pyloric Artery.* It arises from the anterior parts of the hepatic, on the right side of the pylorus, whence it ascends, from right to left, along the small curve of the stomach, to anastomose with the termination of the coronary artery of the stomach (2445), after a course of greater or less length. It gives to the two surfaces of the stomach and to the pylorus twigs, which inosculate with those of the right gastro-epiploic artery.

2451. *Right Gastro-epiploic Artery.* It arises to the right of the pylorus and beneath it, and comes off from the lower part of the hepatic. Its size is considerable. It descends at first vertically behind the stomach as far as its great curvature, applied posteriorly upon the second portion of the duodenum, and covered to the left by the pancreas. It then proceeds from right to left along the great curvature of the stomach, in the substance of the anterior lamina of the great omentum, as far as the middle part of that curvature, where it inosculates with the left gastro-epiploic artery.

In its *vertical portion*, this artery gives off to the right twigs of indeterminate number, and inconsiderable size, which throw themselves into the walls of the duodenum, and to the left, a small branch, which runs transversely along the posterior surface of the pancreas, in which it terminates by anastomosing with the pancreatic and splenic branches.

In its *horizontal portion*, along the great curvature of the stomach, it furnishes superiorly numerous twigs, which ascend in a flexuous manner over the two surfaces of the viscus, and anastomose with those of the pyloric artery and coronary artery of the stomach. Inferiorly, it sends off some which descend vertically between the laminæ of the great omentum, and gain, by being reflected in the posterior lamina, the edge of the arch of the colon, where they inosculate with the colic arteries.

2452. When the hepatic artery has furnished these two arteries, it gains the groove of the liver, ascending to the right before the vena portæ, and behind the hepatic duct, to the right side of the lobule of the liver, and there divides into two considerable branches, a right and a left.

2453. *Right Branch.* Directed upwards and outwards, it crosses the direction of the hepatic duct, beyond which it furnishes the *Cystic Artery*, which gains the neck of the gall-bladder, and spreads out in the lower part of the walls of that reservoir, where it winds for some time between the serous and mucous membranes of which it is composed. The cystic artery moreover sends a very considerable twig between the liver and gall-bladder, to be distributed in the substance of both.

After the origin of the cystic artery, the right branch of the hepatic artery dives in the transverse groove of the liver, and loses itself by ramifying in its right lobe.

2454. *Left Branch.* Proceeding obliquely upwards and inwards, it dives in the transverse groove, and loses itself in the left lobe and in the lobulus Spigelii of the liver, accompanying, like the preceding, the divisions of the vena portæ.

OF THE SPLENIC ARTERY.

2455. In the adult it is larger than the hepatic, the reverse of which is observed in the child. At its commencement, it passes from right to left, forming numerous and very distinct flexuosities, along the upper part of the pancreas which lodges it in a particular groove. It thus arrives at the fissure of the spleen, after furnishing several branches, which are the following.

2456. *Pancreatic Branches.* They come off, in irregular number, from the lower part of the splenic artery, dive perpendicularly into the parenchyma of the pancreas, and then subdivide, to be united with the twigs of the pancreatic artery furnished by the right gastro-epiploic (2451).

2457. *Left Gastro-epiploic Branch.* It arises from the trunk itself of the splenic artery, or only from one of the branches by which it terminates. Its size is generally equal to that of the right gastro-epiploic; but it is frequently much larger, so as to appear to form the true continuation of the artery which gives rise to it, having its direction changed. It ascends at first a little to the left towards the great extremity of the stomach, is concealed for some time by it, and then descends along the great curvature. At its commencement, it throws some ramifications into the pancreas; but along the great curvature, it sends upwards, over the two surfaces of the stomach, and downwards, into the great omentum, twigs of larger size, which are distributed precisely in the same manner as those of the right gastro-epiploic artery, with which it anastomoses towards the middle of the great curvature (2451).

2458. At some distance from the fissure of the spleen, the artery divides into two or three branches, which subdivide themselves into seven or eight twigs, which diverging from each other, following a longitudinal straight line, and contained at first between the two laminæ of the peritoneum, gain the inner surface of the spleen after a course of about two inches. They penetrate into that viscus by so many separate apertures which are observed along its fissure, presently subdivide to infinity, anastomosing with each other by arches, and seem in a great measure to constitute the proper tissue of the organ.

2459. *Vasa Brevia.* These are pretty large but very short twigs, which come from the terminating branches of the splenic artery before their entrance into the spleen, and immediately pass to the large extremities of the stomach, near the cardia, whence they expand over the two surfaces of that organ, anastomosing with the transverse œsophageal twigs of the coronary artery (2446). In this manner, they serve to complete the arterial circle which envelopes the cardia.

d. OF THE SUPERIOR MESENTERIC ARTERY.

2460. It arises from the anterior and right part of the aorta, very little below the cœliac, which it almost equals in size, but which it greatly exceeds in length. It immediately ascends a little to the left and forwards, behind the pancreas and before the third portion of the duodenum, and passing behind the transverse mesocolon and to its left side, goes to gain the upper extremity of the mesentery, between the two folds of which it enters, directing itself downwards and to the right, and describing a very elongated curve, the convexity of which is turned to the left and forwards, and approaches so much nearer the intestine the lower it is examined. Towards the end of the ileum, the superior mesenteric artery, now become very slender, anastomoses with the inferior branch of the inferior right colic artery.

2461. Near its origin, it gives off some very small branches, which go to the duodenum and pancreas, and communicate with twigs of the splenic and hepatic arteries. But, in the mesentery, it furnishes a great quantity of large branches, which may be distinguished into those which come from its concavity, and those which emanate from its convexity.

BRANCHES WHICH THE SUPERIOR MESENTERIC ARTERY GIVES OFF BY ITS CONCAVITY.

RIGHT COLIC ARTERIES.

2462. *Superior Right Colic Artery.* (*Artère méso-colique,* Chauss.) It arises from the right and somewhat anterior part of the superior mesenteric artery, at the moment when the latter passes along the transverse mesocolon. It immediately directs itself from behind forwards, between the two laminæ of that replication, and runs horizontally to near the middle part of the arch of the colon. There, it divides into two branches, which separate from each other to right and left, forming a more or less open angle. The right branch runs along the right part of the arch of the colon, and presently anastomoses with a twig of the middle right colic artery. The left follows the corresponding part of the same intestine, and in the lumbar region inosculates with the ascending branch of the superior left colic artery.

2463. *Middle Right Colic Artery* (*Artère colique droite,* Chauss.) It arises a little beneath the preceding, which sometimes furnishes it, and directs itself obliquely to the right, forwards and a little upwards in the mesocolon. On arriving near the upper part of the right lumbar colon, it divides, like the preceding into two branches, one of which bends to the left and inosculates with the right branch of the superior colic artery (2462), while the other descends to unite with the ascending twig of the inferior right colic.

2464. *Inferior Right Colic Artery (Artère cœcale*, Chauss.) It is a little larger than the preceding, which it is found to approach very near at its commencement. Directed transversely to the right in the mesocolon, it divides, near the cœcum, into three branches. The first bends from beneath upwards, and communicates with the descending branch of the middle right colic artery. The second descends in the mesentery, and unites with the extremity of the superior mesenteric artery itself (2460). The third is transverse, and arises from the angle of the other two. It gains the posterior part of the colon and cœcum, at the moment when these two intestines communicate. From thence it sends a small twig into the peritoneal fold of the vermiform appendage. This twig, in descending, forms a small arch, from the convexity of which proceed parallel ramifications which go to lose themselves in the walls of the appendage. It then separates into two twigs, of which one ascends behind the colon, while the other descends behind the cœcum. Both divide into a multitude of small twigs which belong to the walls of these intestines.

2465. In anastomosing with each other, as we have pointed out, the right colic arteries form distinct arches, whose convexity is turned towards the intestine, and their concavity towards the mesocolon. These arches give off no twigs by their concavity, but by their convexity they send off a very great number. These, for the most part, on leaving the arches, direct themselves parallel to each other as far as the colon; but several of them, following an oblique direction, meet and anastomose so as to constitute areolæ of various forms, whence arise other secondary twigs which go directly to the intestine. When they are all arrived there, they subdivide, upon its two surfaces, into slender twigs which dive beneath the serous coat, and form a very fine net-work in the other coats. Those which belong to the cœcum are much closer and more numerous than those of the colon.

BRANCHES WHICH ARISE FROM THE CONVEXITY OF THE SUPERIOR MESENTERIC ARTERY.

2466. Their number is very variable, but commonly extends from fifteen to twenty. Their volume and length diminish from the upper towards the lower, which are mere slender twigs. They all direct themselves more or less obliquely downwards and to the left between the two laminæ of the mesentery, approaching the small intestine, for which they are destined, as well as for the lower third of the duodenum. At the end of a rather short course, each of them divides into two twigs which separate from each other and unite by arches with those of the neighbouring branches. From the convexity of these primary arches, there arise other smaller twigs, which presently divide in the same manner, and constitute secondary arches by new anastomoses similar to the first. These second arches in like manner give rise to other twigs which form third arches ; and from these again come off others of a fourth order, which themselves produce a fifth, quite close to the intestine.

2467. All these twigs thus constitute in the mesentery a kind of net-work, of which the very numerous areolæ vary in their form and size. These areolæ are themselves traversed by very delicate twigs which go from one branch to another, and which by the way give ramifications to the mesentery and its lymphatic ganglia.

2468. Near the edge of the small intestines, in the place where the two laminæ of the mesentery leave a triangular interval between them, the vascular net-work, which we have described, abruptly ceases, and furnishes a great number of small parallel twigs, which proceed directly over the two surfaces of the intestines, and live in the cellular tissue between the mucous and muscular coats. There, they ramify and subdivide to infinity, taking the appearance of small shrubs. When they have arrived at the convex edge of the intestine, those of one side anastomose with those of the opposite side, in such a manner as to represent a kind of rings.

2469. The capillary ramifications which the mucous membrane receives from all these branches form at its surface a net-work of the greatest delicacy, which spreads out in the valvulæ conniventes and in the villosities which it presents.

d. OF THE INFERIOR MESENTERIC ARTERY.

2470. Somewhat smaller than the superior, it arises much lower rom the anterior and left part of the aorta, at the distance of an nch and a half from its termination. It descends at first a little o the left, behind the lamina of the peritoneum, which goes to orm the corresponding lamina of the mesentery. Then, bending o the right, it enters into the substance of the iliac mesocolon (2125), forming a much less extended curve than that of the supe-ior mesenteric artery, and whose convexity also looks to the left. Arrived at the brim of the pelvis, it prolongs itself into the poste-ior separation of the mesorectum, and reaches near to the anus.

2471. The concavity of the curve formed by the inferior mesen-eric artery produces no branch, but there issue a great quantity rom its convexity. Of these the three principal branches have received the name of *Left Colic Arteries.*

2472. *Superior Left Colic Artery (Grande Colique gauche,* Chauss.) It is the largest of the three, and comes off opposite the bifurcation of the aorta. Directed almost transversely to the left, t arrives near the lumbar colon of the same side, and there sepa-ates into two branches, one of which ascends as far as the arch of he colon, and anastomoses with the left branch of the superior ight colic artery (2462), while the other descends in the iliac me-ocolon, and there inosculates with the ascending branch of the niddle left colic artery.

2473. *Middle Left Colic Artery.* It often arises from the preceding, and is sometimes wanting. It directs itself towards the first curve of the sigmoid flexure of the colon, and there divides into two branches, one of which ascends to form an arch with the descending branch of the superior left colic artery, while the other unites with one of the branches of the inferior left colic.

2474. *Inferior Left Colic Artery (Petite Colique gauche* Chauss.) It directs itself towards the middle part of the sigmoid flexure of the colon, and also separates into two branches. The upper ascends to form an arch with the preceding. The lower descends to unite with one of the twigs furnished in the meso-rectum by the inferior mesenteric artery.

2475. These left colic arteries, on arriving at the intestine, exhibit precisely the same arrangement as those of the right side (2465); that is to say, after forming arches to which succeed some areolæ, they send over the two surfaces of the colon twigs at first parallel, and afterwards divided a great number of times.

2476. After furnishing the three left colic arteries, the inferior mesenteric gives off some small, and in all respects very irregular arteries, and presently after divides into two branches, which descend along the posterior surface of the rectum, and which are called the *Superior Hæmorrhoidal Arteries (Artère du rectum* Chauss.) These two arteries, from being at first superficial, soon after conceal themselves in the layer of longitudinal fleshy fibres of the intestine, progressively diminish in size, and end by very minute twigs, after giving off laterally a great number which embrace from behind forwards the circumference of the rectum, and anastomose on its fore part with each other and with the middle and inferior hœmorrhoidal arteries. Some of them leave the rectum upon its sides, and go to communicate with the lateral sacral arteries.

BRANCHES WHICH ARE GIVEN OFF LATERALLY BY THE ABDOMINAL AORTA.

a. OF THE MIDDLE CAPSULAR (*Artères surrenales*, Chauss.)

2477. These arteries, which are two in number, one on each side are called middle, to distinguish them from those which the diaphragmatic above, and the renal below, send to the supra-renal capsule Their size is very inconsiderable, and they come off from the lateral parts of the aorta a little above the renal arteries. Sometimes they are produced by the cœliac trunk. Directed transversely over the sides of the vertebral column, they gain the anterior edge of the capsules, and divide into several branches which spread out upon the two surfaces of these organs, and ramify in their substance Before arriving at the supra-renal capsules, they frequently throw several small twigs into the pillars of the diaphragm, and into the mass of adipose cellular tissue which envelopes the kidneys. Th left, moreover, gives some twigs to the colon and spleen; the right to the duodenum and liver.

b. OF THE RENAL OR EMULGENT ARTERIES.

2478. Of large size, and very short, and generally two in number, one on each side, they come off below the capsular arteries and the superior mesenteric, forming with the aorta an angle approaching more or less to a right one. The left is commonly a little more anterior and higher than the right. Immersed in a very abundant adipose cellular tissue, directed transversely over the sides of the bodies of the vertebræ, covered by the renal vein and peritoneum on both sides, and, on the right only, by the vena cava inferior, they arrive, after a rather short course, at the fissure of the kidney, where they divide into two, three, or four large branches.

2479. Before arriving at the kidney, they give off only very slender twigs and in indeterminate number, which ascend towards the supra-renal capsule, or lose themselves, under the name of *Adipose Arteries*, in the surrounding fat. They also, however, frequently furnish the spermatic arteries.

2480. The three or four branches which terminate each renal artery separate from each other, and introduce themselves into the kidney, between the pelvis, which is behind and below, and the roots of the renal vein, which are before. They presently divide into a considerable number of twigs which pass between the walls of the pelvis and parenchyma of the kidney, and subdivide around the calyces into a certain number of small twigs. These pass round each of the bundles of tubes which are to form one of the mammillæ of the kidney, and anastomose with each other so as to constitute a distinct arch, the convexity of which is turned towards the cortical substance, which receives a prodigious number of ramifications from it.

2481. In some subjects there are three or four renal arteries on each side; but this arrangement is not of frequent occurrence.

c. OF THE SPERMATIC ARTERIES.

(*Artère testiculaire et Art. de l'ovaire*, Chauss.)

2482. Two in number, one on each side, very slender and of great length, they come off from the anterior or lateral parts of the aorta, and sometimes from the renal arteries. They do not always both come off from the aorta at the same level, but pretty frequently one of them is higher than the other. In all cases, however, forming with it a very acute angle below, they descend almost vertically, and only a little outwards, over the sides of the vertebral column, before the psoæ muscles and ureters, whose direction they cross, and behind the peritoneum. The right passes moreover, backwards, or before the vena cava inferior. Their course is extremely flexuous. They are presently after united to the spermatic veins, and are distributed very differently in the male and in the female; after previously giving off, in either sex, very small twigs to the fat and lymphatic ganglia of the surrounding parts, as well as to the walls of the ureters and to the peritoneum.

2483. *In the Male*, the spermatic artery, placed beside the vas deferens, issues by the inguinal ring, and is distributed to the testicles, giving off by the way ramifications to the different parts which constitute the spermatic cord. At the moment when it terminates, it divides into two bundles of twigs, one of which goes to the epididymus, the other to the testicle. The first penetrate by the head of the epididymis, are expanded in that body, and give some ramifications to the tunica albuginea and the substance of the testicle. The others penetrate into the testicle by its upper edge, and give to the tunica albuginea a great quantity of ramifications, which afterwards lose themselves upon the fibrous septa lying between the masses of the spermatic ducts.

2484. *In the Female*, after crossing the edge of the psoas muscle, the spermatic artery dives into the pelvis and goes to the ovary. Most of its twigs lose themselves in the tissue of that organ. The others are distributed in the Fallopian tube, the round ligament teres, and on the sides of the uterus, where they anastomose with the uterine arteries.

d. OF THE LUMBAR ARTERIES.

2485. They are commonly four on each side. Five, however, are not unfrequently met with, and sometimes only three. Their size is always greater than that of the intercostal arteries. They come off as much from the posterior part as from the sides of the aorta, and direct themselves more or less transversely outwards over the middle of the bodies of the first four lumbar vertebræ, being covered by the psoas magnus, or by the pillars of the diaphragm. Arrived at the base of the transverse processes, they divide into a dorsal or posterior branch, and an anterior or lumbar branch, properly so called, after sometimes giving a few small twigs to the bodies of the vertebræ, the cellular tissue, and the lymphatic ganglia of the loins, the pillars of the diaphragm, and psoæ muscles.

2486. The dorsal branches of the four lumbar arteries are very slender. They send at first into the vertebral canal a twig which is distributed to the spinal marrow and its envelopes, and then dive into the substance of the fleshy mass of the sacro-spinalis muscle, where they lose themselves, sending some ramifications into the intertransversales and transverso-spinales muscles, and into the integuments. They anastomose with each other.

ANTERIOR BRANCHES OF THE LUMBAR ARTERIES.

2487. *First Lumbar Artery.* It directs itself outwards, under the lower edge of the twelfth rib, following exactly the attachment of the diaphragm. It then bends downwards, and descends almost vertically between the peritoneum and transversus abdominis muscle, in which latter it loses itself.

2488. *Second Lumbar Artery.* Its anterior branch, which is of small size, descends in the substance of the quadratus lumborum and ramifies there.

2489. *Third Lumbar Artery.* Its anterior branch, which is very large, dives between the quadratus lumborum and transversus abdominis muscles, bends towards the iliac crest, and divides, towards the posterior third of the latter, into two large twigs, which pass through the broad muscles of the abdomen near their origins, and descend backwards into the glutæus muscles, where they lose themselves, communicating with the twigs of the glutæal artery.

2490. *Fourth Lumbar Artery.* Its anterior branch, which is still larger than that of the preceding muscle, directs itself transversely between the psoas magnus and quadratus lumborum, along the inferior attachment of the latter, throws large twigs upon the iliacus muscle, passes above the iliac crest, and is equally dispersed in the glutæi muscles.

OF THE ARTERIES WHICH TERMINATE THE AORTA BELOW.

a. OF THE MIDDLE OR ANTERIOR SACRAL ARTERY.

2491. The *Middle Sacral Artery (Artèria sacra media,* Soemm. *Artère mediane du sacrum,* Chauss.) It arises from the posterior part of the aorta, a little above its bifurcation, before the fourth lumbar vertebra. Its size is about the same as that of the lumbar arteries; but it is frequently much less. It descends vertically, and in a flexuous manner, over the sacro-vertebral articulation, and upon the anterior surface of the sacrum, placed in the median line of the body behind the rectum, the superior hemorrhoidal vessels, and the nerves of the hypogastric plexus. It is very slender when it arrives at the coccyx, and terminates towards the summit of that bone, anastomosing by two arches with the lateral sacral arteries, and sending small twigs into the fat which surrounds the rectum, and into the ischio-coccygeus muscle.

2492. The middle sacral artery furnishes a great number of lateral branches. The first frequently take the place of one of the inferior lumbar arteries. They are generally very small and very irregular, and communicate with the ileo-lumbar arteries. The others, which are larger, come off to the right and left, at the middle of each false vertebra of the sacrum. Straight or flexuous, they direct themselves transversely outwards, and unite, near the anterior sacral holes, with the branches of the lateral sacral arteries. Sometimes they pass through these holes, and are distributed upon the last vertebral nerves. In their course they furnish many ramifications to the periosteum of the sacrum.

b. OF THE COMMON ILIAC ARTERIES.

(*Artères Pelvi-crurales*, Chauss.)

2493. They result from the bifurcation of the aorta, opposite the body of the fourth lumbar vertebra, or upon the fibro-cartilage which unites that vertebra to the fifth. They are of equal size, and descend, separating from each other at an acute angle, and directing themselves a little forwards, as far as the sacro-iliac symphysis, where they divide each into two large arteries which are called the *Hypogastric* and *External Iliac*. In the female, on account of the breadth of the pelvis, the two common iliac arteries form a larger angle than in the male.

2494. The right common iliac artery passes before the end of the vein of the same name, and covers in a great part the vena cava inferior. The left is coasted internally and posteriorly by the left common iliac vein, and is only covered by the peritoneum. The ureters cross, anteriorly and at right angles, the direction of each of them. Externally, they are both applied upon the psoæ muscles.

2495. In their course, these arteries give off no branch. They only give a few very slender twigs to the walls of the iliac veins, the peritoneum, the lumbar lymphatic ganglia, and the ureters.

OF THE HYPOGASTRIC OR INTERNAL ILIAC ARTERY.

2496. The *Hypogastric Artery* (*Artère pelvienne*, Chauss.) which is a little smaller than the external iliac, dives almost vertically into the excavation of the pelvis, before the sacro-iliac symphysis, and, directing itself a little forwards, forms a slight curve, of which the convexity is posterior. At the end of a very short course, it separates into a very great number of branches, which arise sometimes separately, and sometimes by common trunks, and which are distinguished into posterior, anterior, internal and inferior.

POSTERIOR BRANCHES OF THE HYPOGASTRIC ARTERY.

a. OF THE ILIO-LUMBAR ARTERY.

(*Art. Iliaco-muculaire*, Chauss.)

2497. It comes from the hypogastric, opposite the base of the sacrum, or issues a little farther down from the glutæal. It varies much in size. It ascends a little outwards and backwards, before the lumbo-sacral nerve (1744), and behind the psoas muscle, which receives some ramifications from it. Arrived towards the anterior edge of the base of the sacrum, it divides into two branches, the one ascending, the other transverse.

2498. *Ascending Branch.* It ascends vertically between the psoas muscle, ossa ilii and last vertebra, and terminates by anastomosing with a branch of the fourth or fifth lumbar artery. It throws ramifications into the psoas, iliacus and quadratus lumborum muscles, and into the periosteum of the sacrum and the iliac bones. One of its principal twigs enters into the vertebral canal, under the fourth or fifth lumbar vertebra, and is distributed to the dura mater and nerves which terminate the spinal marrow anastomosing with the artery of the opposite side, the lateral sacral and the last umbar.

2499. *Transverse Branch.* It directs itself outwards, between the psoas and iliacus muscles, and almost immediately subdivides nto two orders of twigs. Some of these twigs, the *superficial*, spread out upon the anterior surface of the iliacus muscle, beneath the peritoneum, and go to anastomose anteriorly with the circumlex iliac. The other, or *deep* twigs, penetrate into the muscles, and are distributed in all directions to its fleshy fibres and to the periosteum of the iliac fossa. One of them, of considerable size, introduces itself into the spongy tissue of the iliac bone, by the hole which is observed at the middle of the iliac fossa.

b. OF THE SACRO-LATERAL ARTERY.

2500. Sometimes there is only one on each side, and sometimes, and even more frequently, two are met with. It arises from the hypogastric artery itself, or from the ilio-lumbar or glutæal. Directed obliquely inwards and downwards, it descends before the anterior sacral holes, and reaches the summit of the coccyx, where it anastomoses by an arch with the middle sacral artery. Sometimes it does not go so far, but passes through the third or fourth sacral hole, and loses itself upon the spinal marrow and in the muscles of the sacral grooves. Its twigs are external and internal.

2501. *External* or *Posterior Twigs.* They are larger than the nternal, and are commonly four in number, they introduce themselves into the sacral canal by the anterior sacral holes, and presently divide each into two secondary twigs, one of which passes over the anterior wall of the sacral canal, giving ramifications to the membrane which lines it, and to the gangliform bulging of the sacral nerves, while the other issues by the posterior sacral hole, and loses itself in the muscles of the vertebral grooves. Those of one side generally communicate with those of the opposite side.

2502. *Internal Twigs.* They spread out their ramifications in the sacral nerves and ganglia, in the pyramidalis muscles, and upon the periosteum of the sacrum. They anastomose on the fore part of that bone with the lateral branches of the middle sacral artery.

e. OF THE GLUTÆAL OR POSTERIOR ILIAC ARTERY.

2503. This is one of the largest branches of the hypogastric artery, from which it rises a little beneath the preceding, which are often furnished by it. Directed downwards, outwards and backwards, it issues from the pelvis by the upper part of the sciatic notch, above the pyramidalis muscle, between the sacro-lumbar nerve and the anterior branch of the first sacral nerve. It gains the posterior part of the pelvis, is covered by the glutæus maximus, and near the posterior edge of the glutæus minimus, divides into two branches, the one superficial, the other deep.

2504. Before issuing from the pelvis, this artery sends some small twigs to the rectum, pyramidalis muscles and neighbouring cellular tissue.

2505. *Superficial Branch.* It directs itself a little outwards, between the glutæus maximus and glutæus medius muscles, and separates into a great many twigs which are diffused in their substance, and in the posterior sacro-sciatic ligament. Some of them anastomose with those of the sciatic artery.

2506. *Deep Branch.* It ascends from behind forwards, between the glutæus medius and glutæus minimus, gives first a nutritious twig to the posterior part of the iliac bone, and immediately subdivides into three secondary branches. Of these, the *upper* follows the direction of the convex edge of the glutæus minimus, approaches the iliac crest, and forms a large arch which terminates near the anterior and superior spine, after furnishing numerous twigs to the glutæus medius by its convexity, and to the glutæus minimus by its concavity. The second, *middle* and transverse twig, which is much larger, passes over the glutæus minimus, from which it is separated by much fat, gives twigs to it, and then throws itself into the glutæus medius, reaching to near the great trochanter. The third or *lower* twig, which is about the same size as the upper, first gives some twigs to the pyramidalis and glutæus minimus muscles. It then descends upon the latter, traverses its fibres, passes over the iliac bones, enters beneath the tensor vaginæ, and loses itself upon the capsule of the hip-joint and in the glutæus medius and minimus and rectus femoris muscles, anastomosing with twigs of the femoral artery.

ANTERIOR BRANCHES OF THE HYPOGASTRIC ARTERY.

a. OF THE UMBILICAL ARTERY.

2507. Directed obliquely forwards and inwards as far as the lateral and upper part of the bladder, it then bends upwards to ascend behind the anterior wall of the abdomen, where it is contained in a fold of the peritoneum, and whence it directs itself towards the umbilicus, approaching the urachus and that of the opposite side.

2508. In the adult, the artery is in a manner obliterated. Beyond the bladder, it no longer receives blood, and is converted into a true ligament as far as the umbilicus. Even at the first portion of its course its walls are so thick, that the colour of the fluid which they contain cannot be perceived through them.

2509. But in the fetus, it is of large size, and appears to form the true continuation of the trunk of the hypogastric artery. On arriving at the umbilicus it issues by that aperture, forms part of the umbilical cord, and gains the placenta, twisting upon itself a great number of times. It then seems to furnish all the other branches of the hypogastric, while near its commencement it gives off only a few very slender twigs to the bladder and uterus.

b. OF THE VESICAL ARTERIES.

2510. They present many variations as to number and origin. The umbilical artery always furnishes three or four, which ramify in the walls of the bladder, and anastomose there with each other, and with the neighbouring branches. The middle hæmorrhoidal, internal pudic, and obturator arteries furnish others. But the hypogastric produces one a little larger, (*Artère vesico-prostatique*, Chauss.) which gains the fundus of the organ, and sends it numerous twigs, as well as to the commencement of the urethra, and in the male, to the prostate gland, vesiculæ seminales and vas deferens. Its last ramifications reach as far as the rectum.

c. OF THE OBTURATOR ARTERY.

(*Art. Sous-pubio-femorale*, Chauss.)

2511. It arises most commonly from the hypogastric or glutæal, but is also sometimes produced by the epigastric; and, in the latter case, descends vertically behind the iliac bone as far as the obturator hole. In the former case, which, as we have said, is the most common, it directs itself forwards and outwards, then turns horizontally into the excavation of the pelvis, over the obturator internus muscle, under the nerve of the same name, along with which it issues from the pelvis through the empty space left by the obturator membrane. In this course it is slightly flexuous.

2512. Near its origin, it gives off a pretty large twig which ascends under the obturator nerve, arrives in the iliac fossa, and is distributed deeply in the iliacus internus muscle. It then throws a great number of small twigs into the obturator internus muscle, upon the neighbouring lymphatic ganglia, and sometimes upon the bladder. Immediately before entering into the obturator hole, it gives off a small branch which directs itself behind the symphysis pubis, spreads out some ramifications upon the periosteum, and anastomoses with a similar branch of the opposite obturator artery.

2513. At its exit from the pelvis, on the upper edge of the obturator externus muscle, the obturator artery divides into two branches, a posterior and an anterior.

2514. *Posterior Branch.* It descends along the outer edge of the obturator hole, placed between the two obturator muscles, in which it sometimes directly loses itself. In general, however, it reaches as far as the sciatic tuberosity, bends outwards beneath the quadratus femoris muscle, and gains transversely the back part of the thigh, where it gives several twigs to the ilio-femoral articulation, and anastomoses with the descending branch of the sciatic artery. It loses itself in the surrounding muscles; but there is detached from it a very remarkable small twig, which penetrates into the cotyloid cavity by its inferior notch, and goes to be distributed to the reddish cellular tissue which fills the deepest part of that cavity.

2515. *Anterior Branch.* It descends between the first and second adductor muscles, giving off twigs to them, as well as to the obturator externus, pectineus, and gracilis muscles, and to the integuments of the upper and inner region of the thigh and of the genital parts. It terminates by anastomosing with a twig of the internal circumflex artery, or by losing itself in the muscles and skin. Near its commencement, it sends off a small twig which descends along the internal edge of the obturator hole, to anastomose with a twig of the posterior branch, so that this foramen is truly surrounded by a complete arterial circle.

INTERNAL BRANCHES OF THE HYPOGASTRIC ARTERY.

a. OF THE MIDDLE HÆMORRHOIDAL ARTERY.

2516. It is sometimes wanting, and is of more constant occurrence in the female than in the male. It varies much in its size and origin, frequently coming off from the ischiatic or internal pudic. It descends obliquely over the anterior part of the rectum, behind the fundus of the bladder in the male, and behind the vagina in the female. It separates into a great number of twigs, which expand in these different parts, and anastomose superiorly with the hæmorrhoidal twigs of the inferior mesenteric artery, and inferiorly with those of the internal pudic.

b. OF THE UTERINE ARTERY.

2517. Its volume is always in relation with the state of development of the uterus, so as frequently to be very small, while in other cases, at the end of gestation, for example, it is larger than any other branch of the hypogastric artery. It arises from the hypogastric, whether separately, or along with the umbilical, or from the internal pudic. It directs itself at first upon the lateral and upper part of the vagina, between it and the bladder, giving off a certain number of twigs to both these organs. It then ascends, in the substance of the ligamentum latum, upon the sides of the uterus, and has an extremely flexuous course. There, it divides into a great number of twigs which penetrate into the tissue of the organ, proceed transversely and in a flexuous manner over its two surfaces, and anastomose in the median line with those of the opposite side. It also throws upon the Fallopian tube and ligamentum teres some small twigs which inosculate with those of the spermatic arteries (2484). There also commonly proceeds from it one which goes to the vagina, and which frequently traverses its whole length.

c. OF THE VAGINAL ARTERY.

2518. Like the preceding, it exists only in the female. Sometimes even it is not met with, and is then replaced by twigs of the uterine, vesical and middle hæmorrhoidal arteries, which are distributed in the walls of the vagina. It arises from the hypogastric artery, the internal pudic, the umbilical, the middle hæmorrhoidal, and sometimes from the obturator artery. It descends forwards, furnishing a pretty large twig to the lateral region of the bladder, then continues its course over the side of the vagina, gives it numerous branches, and reaches as far as its orifice, whence it distributes ramifications to the external parts of generation.

INFERIOR BRANCHES OF THE HYPOGASTRIC ARTERY.

a. OF THE ISCHIATIC ARTERY.

(*Art. Fémoro-poplitée,* Chauss.)

2519. It arises from the hypogastric separately, or along with he glutæal. A little smaller than the latter, it yet appears to be he true continuation of the trunk of the hypogastric. Directed lmost vertically downwards between the rectum and the walls of he pelvis, before the pyramidalis muscle, it issues through the ower part of the sciatic notch, between the inferior edge of that nuscle and the anterior sacro-sciatic ligament, leaving behind it he great sciatic nerve.

2520. In the pelvis, this artery furnishes some twigs, not of very onstant occurrence, to the rectum, the bladder, the uterus, and the evator ani muscle. It also sometimes gives off the two pudic, the niddle hæmorrhoidal and the obturator arteries.

2521. At its leaving the pelvis, the ischiatic artery separates in-o several large branches. One of them directs itself obliquely lownwards and inwards, following the origin of the glutæus maximus which covers it, gives off twigs to it, and arrives towards the coccyx, where it loses itself in the ischio-coccygeus and levator ani muscles, and in the fat of that part. Another branch is distributed in the lower third of the glutæus maximus and in the cellular tissue which surrounds the sciatic tuberosity. The third which seems to continue the course of the artery, accompanies the sciatic nerve as far as the inferior and posterior part of the thigh, and gives twigs to the glutæus maximus, quadratus, gemelli, biceps, semi-tendinosus, semi-membranosus and adductor magnus. It ends by anastomosing with the perforating and circumflex arteries.

b. OF THE INTERNAL PUDIC OR GENITAL ARTERY.

(*Artère Sous-pubienne*, Chauss.)

2522. A little smaller than the ischiatic, it is very often given off by it. It descends, vertically and slightly flexuous, before the sciatic plexus and pyramidalis muscle, and issues from the pelvis by the lower part of the great sciatic notch, between the pyramidalis muscle and the posterior edge of the levator ani, united to the anterior sacro-sciatic ligament, being only separated from the ischiatic artery by a layer of fat. Immediately after, it directs itself downwards and inwards, passes between the two sacro-sciatic ligaments, bends over the anterior, which it embraces externally, places itself upon the internal surface of the ischium, between the obturator internus and levator ani muscles, proceeds nearly horizontally forwards and inwards to near the common origin of the ischio-cavernosus and transversus perinæi muscles, and there divides into two branches, which are differently distributed in the male and in the female, and of which one is inferior and the other superior.

2523. In the pelvis, the internal pudic artery sometimes gives rise to the middle hæmorrhoidal, obturator, &c. But it always sends some ramifications to the bladder, the vesiculæ seminales, the prostate gland, the commencement of the urethra, the rectum, and, in the female, to the upper part of the vagina.

2524. Before dividing, and after issuing from the pelvis, it gives off a great number of twigs, of moderate size, which may be distinguished into internal and external. The internal are spread out in the midst of the abundant fat which surrounds the rectum, and go to be distributed to the sphincter ani and levator ani muscles. The others, which are much more slender, descend towards the tuber ischii, and lose themselves in the origins of the flexor muscle of the leg and in the integuments.

2525. *Inferior Branch* (*Artère périnéale*, Chauss.) Smaller than the superior, it runs from behind forwards, between the skin and transversalis perinei muscle, in the adipose cellular tissue which fills the triangular space left between the ischio-cavernosus and bulbo-cavernosus muscle. At first nearer the ramus of the ischium than the raphe, it approaches the latter as it advances, and gives numerous twigs to the anterior half of the sphincter ani muscle, and to the transversalis perinæi, ischio-cavernosus and bulbo-cavernosus muscles, as well as to the integuments. Some of them ascend towards the rectum under the name of *Inferior Hæmorrhoidal Arteries*, and anastomose with the middle hæmorrhoidal and with the termination of the inferior mesenteric.

Then the branch itself passes over the bulbo-cavernosus muscle, dives into the septum of the dartos, assumes the name of *Artery* of the *Septum*, and is distributed to the scrotum, the dartos, and the skin of the penis.

2526. *Superior Branch (Artère-ischio-pénienne,* Chauss.) It traverses the transversus perinæi muscle and then ascends above it, along the ascending branch of the ischium. Concealed by the ischio-cavernosus muscle, it arrives at the triangular cellular interval which separates the two roots of the corpus cavernosum, before the symphysis pubis, where it divides into two twigs which are called the *Dorsal Artery of the Penis*, and the *Artery of the Corpus cavernosum.*

2527. *Transverse Artery of the perinæum. (Artère urethro-bulbaire*, Chauss.) It comes off from the superior branch of the internal pudic, near the origin of the latter, varying much in size. It directs itself inwards and forwards, above the transversus perinæi muscle, as far as the bulb of the urethra, into which it dives, subdividing into several twigs. One of them penetrates into the corpus cavernosum, and there anastomoses with the cavernous artery.

2528. Before its division, and after giving off the transverse artery of the perinæum, the superior branch of the pudic throws small twigs into the obturator internus, ischio-cavernosus, and transversus perinæi muscles, and into Cowper's glands.

2529. *Artery of the Corpus Cavernosum, (Artère profonde du Penis*, Chauss.) It penetrates into the corresponding side of the corpus cavernosum, and presently divides into several secondary twigs, which run along its whole length, and distribute in all directions a great number of ramifications in the midst of the spongy tissue. Some of them perforate the fibrous membrane, and introduce themselves into the walls of the urethra.

2530. *Dorsal Artery of the Penis. (Art. Superficielle du Penis*, Chauss.) It passes through the suspensory ligament of the penis, running along the dorsal surface of the latter, parallel to that of the opposite side. Its course is very flexuous, and it gives numerous small twigs to the fibrous membrane of the corpus cavernosum and to the skin. Near the glans, it subdivides and loses itself in the tissue of that part.

2531. In the female, the *inferior branch* of the internal pudic artery, after sending twigs to the transversus perinæi, sphincter ani and constrictor vaginæ muscles, terminates in the substance of the labium. The *superior branch, (Artère du clitoris*, Chauss.), ascends along the ischium and pubis, as far as the interval between the roots of the corpus cavernosum of the clitoris, throws a twig into the kind of retiform plexus which surrounds the orifice of the vagina, and separates, before the symphysis of the pubes, into two secondary branches, one of which penetrates into the corpus cavernosum of the clitoris, while the other creeps upon the back of that organ.

OF THE EXTERNAL ILIAC ARTERY.

(*Portion iliaque de la crurale*, Chauss.)

2532. Arising from the bifurcation of the common iliac artery, it extends to the crural arch, where it changes its name to assume that of femoral artery. It descends obliquely outwards, along the inner and fore part of the psoas muscle, applied posteriorly and internally upon the external iliac vein, and covered by the peritoneum. It is generally straight, but sometimes forms several curves of greater or less extent.

2533. In its course, it only gives off a few small twigs to the psoas muscle, the peritoneum, and the neighbouring lymphatic ganglia. But, before passing under the crural arch, it furnishes two considerable branches, which are named the *Epigastric* and *Circumflex Iliac* Arteries.

a. OF THE EPIGASTRIC ARTERY.

(*Art. Sus-pubienne*, Chauss.)

2534. It arises inferiorly and internally from the external iliac artery, opposite the superior extremity of the inguinal ring, a little above the crural arch, beneath the place where the peritoneum leaves the anterior wall of the abdomen to be reflected into the iliac fossa, and immediately directs itself inwards and a little forwards, describing some flexuosities. It almost directly enters behind the spermatic cord, whose direction it crosses, and which conceals its origin, and ascends vertically to the inner side of it, behind the upper and outer part of the inguinal ring, between the peritoneum and abdominal aponeurosis. It still follows a little the outer edge of the rectus muscle, and at the distance of about two inches above the pubes, passes upon its posterior surface, along which it proceeds as far as the umbilicus, where it terminates by several twigs.

2535. Near its origin, the epigastric sometimes furnishes the obturator artery, opposite the crural arch. But it always gives twigs to the peritoneum, the neighbouring cellular tissue, and the spermatic cord. One of these twigs issues through the inguinal ring, and is distributed, in the male, to the cremaster muscle, the tunica vaginalis, and the skin of the scrotum, anastomosing with the spermatic artery, and in the female, to the ligamentum teres, mons veneris, and upper parts of the vulva.

2536. Beyond the spermatic cord, the epigastric artery gives off numerous lateral branches which are distributed inwards to the rectus muscle, and outwards to the broad muscles of the abdomen. They furnish numerous ramifications to the peritoneum, and anastomose with the lumbar and last intercostal arteries. The terminating twigs go to communicate with those of the internal mammary artery.

b. OF THE CIRCUMFLEX ILIAC OR ANTERIOR ILIAC ARTERY.

(*Art. Circonflexe de l'ilium*, Chauss.)

2537. It comes off from the outer part of the external iliac, sometimes beneath, sometimes opposite the preceding, which it commonly equals in size. Immersed in an abundant cellular tissue, and concealed by the peritoneum, it ascends obliquely outwards, curving a little along the outer edge of the iliacus internus muscle, until above the anterior and superior spine of the ilium. Then directing itself backwards, it separates into two branches, after giving off *external twigs*, which lose themselves in the transversus abdominis muscle, and *internal twigs*, which are spread out upon the iliacus muscle, anastomosing with the ileo-lumbar artery.

2538. Of the two branches which terminate this artery, the *external*, which is smaller, ascends between the transversus and obliquus internus abdominis muscles, in which it loses itself. The *internal*, which is larger and transverse, runs for some time along the iliac crest, and afterwards ascends a little obliquely backwards, between the transversus and obliquus internus abdominis muscles, in which it divides, as well as in the obliquus externus, anastomosing with the internal mammary artery, the lumbar and inferior intercostal arteries.

OF THE FEMORAL OR CRURAL ARTERY.

2539. Immediately succeeding the external iliac artery, it commences under the crural arch, nearly at the middle of the space which separates the anterior and superior spine of the ossa ilii from the spine of the pubes. Directed at first a little obliquely at the inner and upper part of the thigh, it bends backwards descending, and, above the lower third of the thigh, enters into the aponeurotic groove of the adductor magnus muscle (1315), on emerging from which it assumes the name of *popliteal artery*. It therefore extends from the middle of the crural arch to the end of the fleshy body of the adductor magnus.

2540. Its *anterior side* corresponds to the crural aponeurosis, and to the inguinal lymphatic ganglia, in a triangular space which is formed above by the crural arch, externally by the sartorius muscle, internally by the adductor longus and gracilis, that is to say, in an extent of about four inches. It is separated from all these parts by a great quantity of adipose cellular tissue. Farther down, it is covered by the sartorius muscle which crosses its direction.

2541. Its posterior side rests, at its uppermost part, upon the body of the pubes, from which it is separated by the pectineus muscle, then upon that muscle itself, and upon the small and middle adductors, which are separated from it by a thick layer of fat.

2542. Its *outer side* corresponds at first to the crural nerve, then to the tendon of the psoas and iliacus internus muscles, which separates it from the ilio-femoral articulation. It is then in rather distant relation with the sartorius muscle; and lastly, below, is immediately applied upon the internal portion of the triceps, which separates it from the body of the femur.

2543. Its *internal side* is in contact superiorly with the crural vein, then with the pectineus muscle, and it is at length placed between the adductor longus and sartorius. The latter covers it at the lower part of the thigh.

2544. The branches of the femoral artery are distinguished into internal, external, anterior, and posterior.

INTERNAL BRANCHES OF THE FEMORAL ARTERY.

OF THE EXTERNAL PUDIC ARTERIES.

(*Art. Scrotales ou vulvaires*, Chauss.)

2545. They are two in number, and may be distinguished into *superficial* or *subcutaneous*, and *deep* or *sub-aponeurotic*.

2546. The *Superficial* arises from the femoral artery, at a very small distance from the crural arch. It proceeds transversely inwards between the skin and the crural aponeurosis, directs itself towards the parts of generation, and, before arriving there, divides into two twigs, the one superior, the other inferior. The *superior* ascends towards the pubes, and loses itself in the skin of the lower part of the abdomen, communicating with the epigastric and abdominal subcutaneous arteries. The *inferior* is distributed to the scrotum and skin of the penis in the male, where it extends as far as the prepuce; and to the corresponding labium pudendi in the female.

2547. The second external pudic artery arises a little lower from the femoral or profunda femoris. It descends at first obliquely, and then runs transversely inwards under the crural aponeurosis, which it perforates, to gain the scrotum in the male, and the labium in the female. It anastomoses with the inferior twig of the preceding. Pretty frequently it is crossed anteriorly by the internal saphena vein.

2548. The other internal branches of the femoral artery are a little larger than the preceding; but they vary much as to number, origin, and disposition. They are distributed to the gracilis and adductor longus muscles, and to the integuments.

EXTERNAL BRANCHES OF THE FEMORAL ARTERY.

OF THE SUPERFICIAL MUSCULAR ARTERY.

2549. It comes off from the femoral, nearly at the same place as the deep muscular, and directs itself transversely outwards, between the sartorius and rectus femoris. After a short course, it divides into *ascending twigs* which pass outwards between the iliacus, sartorius and tensor vaginæ femoris, and are distributed to these muscles, and to the glutæus medius. One of them may be traced as far as the lower part of the latter muscle.

2550. The other external branches of the femoral artery are few and of small size. They lose themselves upwards in the psoas and iliacus muscle, and downwards in the triceps extensor.

ANTERIOR BRANCH OF THE FEMORAL ARTERY.

OF THE ABDOMINAL SUBCUTANEOUS ARTERY.

(*Les inguinales*, Chauss.)

2551. It is never absent, and is very slender and of great length. It arises from the artery immediately beneath the crural arch, and ascends obliquely outwards, between the abdominal aponeurosis and the integuments, as far as the level of the umbilicus. It gives twigs to the lymphatic ganglia and cellular tissue of the groin, and to the skin and muscles of the abdomen. It anastomoses with that of the opposite side, and with the epigastric and nternal mammary arteries.

2552. The other anterior branches of the femoral artery are very slender, and are distributed to the cellular tissue, the integuments, or the sartorius.

POSTERIOR BRANCHES OF THE FEMORAL ARTERY.

OF THE ARTERIA PROFUNDA FEMORIS.

(*Grande musculaire de la cuisse*, Chauss.)

2553. It arises from the back part of the femoral artery, an inch and a half or two inches below the crural arch, opposite the middle of the space comprised between the pubes and the small trochanter, and is of large size, nearly equalling the femoral artery itself. It descends obliquely backwards as far as the origin of the middle portion of the triceps extensor muscle, and there bends inwards, proceeding between the femur and the long and short adductors to the middle part of the thigh. It then diminishes in size, passes through the aponeurosis of the adductor longus, gains the posterior surface of the limb, and separates into two thick branches, one of which enters into the short portion of the biceps femoris, and the other into the semi-membranosus.

2554. In this course, the deep muscular artery gives off outwards the external circumflex, inwards the internal circumflex, and backwards the three perforating arteries.

2555. *External Circumflex Artery.* (*Art. Sous-trokantérienne*, Chauss.) It comes off from the outer side of the profunda, at the place where the latter forms a bend to descend inwards. Its size, although generally rather moderate, sometimes equals that of the trunk from which it comes off. Directed almost transversely outwards, behind the sartorius and rectus femoris, it presently divides into two branches: the one *transverse* the other *descending*. The first turns over the upper part of the femur, to gain the outer and back part of that bone. There it divides into several twigs, some of which ascend in the capsule of the hip-joint, while the others are distributed to the inner surface of the outer portion of the triceps extensor, to the glutæus medius, glutæus minimus, tensor vaginæ femoris, and rectus femoris muscles. The second branch, which is much larger, descends along the fore part of the thigh, between the triceps extensor and rectus femoris, and divides into several twigs which are lost in their substance. Some of these twigs extend as far as the patella, and anastomose with the superior articular arteries.

2556. *Internal Circumflex Artery.* (*Art. Sous-trokantinienne*, Chauss.) Larger than the preceding, it arises from the very commencement of the deep muscular artery at its inner and back part. It almost immediately dives from before backwards, between the pectineus and the united tendon of the psoas and iliacus muscles, turns over the inner part of the neck of the femur, running along the obturator externus muscle, under the adductor brevis and adductor magnus. It gives several twigs to these different muscles, the parts of generation, and the ilio-femoral articulation, and arrives behind the neck of the femur, where it divides into two branches. One of these, the *ascending*, is smaller, mounts obliquely upon the neck of the femur, before the quadratus femoris muscle, and dives into the digital cavity of the great trochanter, where it loses itself, being distributed to the quadratus femoris, gemelli, and obturator internus muscles. The other, which is *transverse* and larger, passes at first outwards, between the quadratus femoris and the femur, and divides into two twigs, one of which loses itself in the common origin of the flexor muscles of the leg at the tuber ischii, while the other is distributed to the upper part of the adductor magnus.

2557. *Upper Perforating Artery.* It is larger than the other two, and arises from the back part of the profunda, below the small trochanter. Directed backwards, it passes through the tendons of the second and third adductors, which receive twigs from it, and gains the back part of the femur, where it divides into two branches, one of which ascends in the substance of the glutæus maximus, while the other is distributed in the long portion of the biceps, the outer portion of the triceps, in the semi-membranosus and upon the sciatic nerve. This artery anastomoses with the internal circumflex, ischiatic and middle perforating arteries.

2558. *Middle Perforating Artery.* It comes off lower than the preceding, and is inferior to it in size. It also passes through the aponeurosis of the second and third adductor muscles, and on arriving at the back part of the thigh, divides into ascending twigs, which go towards the great trochanter in the glutæus maximus and triceps muscle, anastomosing with those of the preceding artery, and into descending branches which go to the biceps, semi-tendinosus, semi-membranosus and triceps muscles, and to the sciatic nerve. The latter communicates with those of the inferior perforating artery. One of them penetrates into the femur by the nutritious canal which is observed upon the linea aspera of that bone, (491).

2559. *Inferior Perforating Artery.** This is the smallest of the three. It comes off from the deep muscular artery much lower than the others, and passes through the aponeurosis of the adductor magnus nearly at the same time as the trunk which furnishes it. Its distribution behind the femur is the same as that of the other two.

OF THE POPLITEAL ARTERY.

(*Portion poplitée de la crurale*, Chauss.)

2560. It is the direct continuation of the femoral artery, which changes its name after perforating the adductor magnus. It descends a little obliquely from within outwards into the ham, and extends from the commencement of the lower third of the thigh to the end of the upper third of the leg, where it terminates by dividing.

2561. Its posterior side is covered in the greater part of its extent by the sciatic nerve and popliteal vein. The semi-membranosus muscle is moreover applied upon it above; farther down, a great quantity of fat separates it from the aponeurosis and integuments, and still lower it is protected by the gastrocnemii, plantaris gracilis and soleus muscles.

2562. Its *anterior side* is separated above from the femur by a great quantity of adipose cellular tissue in the middle, and rests upon the posterior surface of the knee-joint, and below upon the popliteus and tibialis posticus muscles.

2563. Its *outer side* corresponds to the biceps muscle, which separates from it below, to the outer condyle of the femur, the external head of the gastrocnemius, plantaris and soleus.

2564. Its *inner side* is near the semi-membranosus muscle, which also retires from it as it descends, and is afterwards in relation with the internal popliteal nerve and the inner head of the gastrocnemius muscle.

2565. The popliteal artery gives off a great number of small branches which go to the sciatic nerve, the adipose cellular tissue, and to the neighbouring muscles and parts; but their number is indeterminate, and their disposition far from regular. Some of them however, which are larger than the rest, merit a separate description.

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* M. Chaussier designates the three perforating arteries by the general name of *Petites Musculaires de la cuisse.*

BRANCHES WHICH THE POPLITEAL ARTERY GIVES OFF IN THE HAM.

2566. They are three in number, and are designated by the name of *Superior Articular Arteries (Art. articulaires poplitées,* Chauss.) They are distinguished into internal, external, and middle.

1. OF THE INTERNAL SUPERIOR ARTICULAR ARTERY.

2567. Its size is always considerable, and it varies much as to its origin. It is seldom single, there being generally two or three. When it exists single, it may arise from the popliteal artery, at the moment when the latter passes through the adductor magnus, or from any other part of its extent down to the level of the condyles. In all cases, it descends inwards, passes under the tendon of the adductor magnus, turns forwards over the inner part of the femur, above the corresponding condyle, and, after throwing some ramifications into the periosteum of that bone, divides into two branches. One of them descends obliquely outwards, between the femur and the triceps muscle, to which it is distributed, as well as to the neighbouring cellular tissue, or is entirely expanded in the muscles, and anastomoses with the twigs of the external circumflex artery. The other branch reaches along with the tendon of the adductor magnus as far as the inner condyle, and there separates into a great number of twigs, which proceed transversely inwards upon the femur, and are distributed to the triceps muscle, or sink into the knee joint, and anastomose with those of the external superior articular artery.

2. OF THE EXTERNAL SUPERIOR ARTICULAR ARTERY.

2568. It arises externally from the politeal artery, immediately above the outer condyle of the femur, and directs itself transversely outwards under the biceps muscle, winding over the femur. It also divides into two branches, of which the upper loses itself entirely in the triceps extensor muscle, while the inner descends obliquely forwards upon the condyle of the femur, under the aponeurosis, as far as the patella, on which it anastomoses with the internal superior articular artery.

3. OF THE MIDDLE SUPERIOR ARTICULAR ARTERY.

2569. Much smaller than the preceding two, it arises from the fore part of the popliteal artery, sometimes above, sometimes opposite the joint. It almost immediately passes horizontally, from behind forwards, through the posterior ligament of the knee joint, and divides into two branches, one of which descends behind the crucial ligaments, and loses itself in the neighbouring cellular tissue, while the other dives into the depression which separates the two condyles of the femur, and is distributed in the fat which occurs there, giving twigs to all the parts of the joint.

BRANCHES WHICH THE POPLITEAL ARTERY GIVES TO THE UPPER PART OF THE LEG.

1. OF THE ARTERIES OF THE GASTROCNEMII MUSCLES.

(*Artèriæ Surales.*)

2570. These arteries are two in number, and come off from the posterior and lateral parts of the popliteal artery, separated from each other at their commencement by the sciatic nerve. They direct themselves obliquely backwards, and gain the middle of the anterior surface of the gastrocnemius muscle. They then dive into its substance, and terminate towards the place where it is united to the soleus by an aponeurosis. Near their origin, they give off some twigs to the plantaris and popliteus.

2. OF THE INTERNAL INFERIOR ARTICULAR ARTERY.

2571. It arises from the popliteal artery above the popliteus muscle, descends obliquely inwards, under the sciatic nerve and gastrocnemius muscle. It then winds over the corresponding tuberosity of the tibia, between the bone and the internal lateral ligament of the knee joint and the united tendons of the sartorius, gracilis and semitendinosus muscles. It then curves from beneath upwards, and ascends along the inner edge of the ligament of the patella, as far as the lower part of that bone, where it anastomoses with a branch of the internal superior articular artery, and with twigs of the external inferior articular.

2572. It gives off some small twigs to the popliteus and gastrocnemius internus. The others are spread out upon the inner side of the articulation, upon the periosteum of the tibia, and even in the integuments.

3. OF THE EXTERNAL INFERIOR ARTICULAR ARTERY.

2573. It arises externally from the popliteal artery, farther down than the preceding, concealed in its origin by the plantaris muscle, under the outer condyle of the femur. It descends obliquely outwards, above the soleus muscle, between the popliteus and gastrocnemius and enters beneath the tendon of the biceps femoris and the external lateral ligament of the knee joint. It gives twigs to all these muscles, then winds over the convex edge of the external semilunar fibro-cartilage, and advances transversely as far as the lower part of the patella. There it divides into two twigs, a deep one, which first supplies some ramifications which descend upon the tibia and anastomose with those of the recurrent twig of the anterior tibial artery, then loses itself in the adipose cellular tissue placed between the tibia and the ligament of the patella, and a superficial, which ascends upon the latter bone, and anastomoses with the external superior articular artery.

2574. Before dividing, this artery, as we have already said, gives twigs to the popliteus, plantaris and soleus muscles. All the others are expanded upon the other part of the knee joint.

2575. After furnishing the inferior articular arteries, the popliteal descends vertically behind the popliteus muscle; and, near the head of the fibula, gives off pretty large twigs to the upper part of the soleus muscle. There also separates from it anteriorly, about the same place, a large branch which is named the *Anterior Tibial Artery.* Then after a course of about an inch, it divides into two branches, which are the *Fibular* and *Posterior Tibial Arteries.*

OF THE ANTERIOR TIBIAL ARTERY.

2576. Directed horizontally forwards at its commencement, it sends some twigs to the tibialis posticus and flexor longus communis digitorum muscles, as well as to the posterior part of the knee joint, and immediately after passes through the upper extremity of the tibialis posticus and the interosseous ligament. It then places itself at the fore part of the leg, bends downwards, descends obliquely between the peroneus longus and tibialis anticus, gradually approaching the tibia, and passes under it below. It then slips under the anterior annular ligament of the tarsus, between the extensor communis digitorum pedis and extensor proprius pollicis, and henceforth assumes the name of *Dorsal Artery of the foot.* (*Artere pedieuse.*)

2577. The *posterior side* of this artery lies, in its four upper fifths, upon the interosseous ligament, and in its lower fourth, upon the tibia. Its *anterior side* is successively covered by the tibialis anticus, extensor communis digitorum and extensor proprius pollicis. The tendon of the latter muscle is the only part which separates it from the skin below. The *inner side* is placed against the tibialis anticus muscle and the tibia. The *outer* corresponds above to the fibula and to the peroneus longus and extensor digitorum communis, and below to the extensor proprius pollicis alone. The anterior tibial nerve lies upon the artery of the same name in its whole extent.

2578. Immediately after passing through the interosseous ligament, and sometimes even its passage, the anterior tibial artery furnishes a considerable branch, the *Recurrent Artery of the Knee,* which ascends obliquely inwards in the substance of the upper extremity of the tibialis anticus, gives it many ramifications, traverses the tibial aponeurosis, and divides into several twigs which anastomose, around the knee joint and in the integuments, with the inferior articular arteries.

2579. In the rest of its extent, this artery gives off laterally a great number of twigs to the peronei, tibialis anticus and extensores muscles, to the periosteum of the tibia and to the integuments. These twigs anastomose internally with those of the posterior tibial artery, and externally with those of the fibular. It also furnishes several posteriorly, which pass through the interosseous ligament, and lose themselves in the posterior and deep muscles of the leg.

2580. Near the ankle, the anterior tibial artery gives off two branches of larger size, an inner and an outer. The inner, which is named the *Internal Malleolar Artery*, passes transversely behind the tendon of the tibialis anticus, gains the inner malleolus, and descends upon the neighbouring part of the tibio-tarsal articulation and of the tarsus itself, where it divides into small twigs, which communicate with those of the posterior tibial artery. The outer branch, or *External Malleolar Artery*, glides behind the endons of the extensor communis digitorum and peroneus tertius muscles, descends along the outer malleolus, passes over the ankle-joint, and gives it some ramifications, as well as to the correspondng side of the tarsus. It communicates with the peroneal artery, he dorsal artery of the foot, and the external plantar.

OF THE DORSAL ARTERY OF THE FOOT.

(Artère Pedieuse.)

2581. This is the direct continuation of the anterior tibial artery, and extends from the ankle-joint to the posterior extremity of he first metatarsal bone, where it enters beneath the first tendon f the extensor brevis digitorum pedis, to gain the sole of the foot y passing vertically through the adductor of the second toe 1387). In this course, the artery, which is slightly flexuous, and irected obliquely from without inwards, and from behind forwards, s successively covered by the skin, the tendons of the extensor ngus digitorum, and the extensor brevis digitorum, and gives off ranches, which are distinguished into internal and external.

2582. *Internal Branches.* They are very numerous, but very ender, and are distributed upon the corresponding ege of the foot, here they anastomose with those of the internal plantar artery.

2583. *External Branches.* They are more numerous and of arger size. They ramify upon the back of the foot, and in the exensor brevis digitorum muscle. Two of them have received parcular names.

2584. *Tarsal Artery* (*Artère sus-tarsienne*, Chauss.) It arises pposite the head of the scaphoid bone, and directs itself outwards and a little forwards under the extensor brevis digitorum muscle, advancing as far as the outer edge of the foot, where it passes under the tendon of the peroneus longus. In this course, it gives a great number of twigs to the extensor brevis digitorum and to the ligament of the tarsus, and terminates by several small twigs which anastomose with those of the external plantar artery.

2585. *Metatarsal Artery (Artère sus-metatarsienne,* Chauss.) Smaller than the preceding, it arises from the dorsal artery of the foot, near the place where the latter enters the first interosseous space. Directed forwards and outwards under the extensor brevis digitorum, it forms a curve of which the concavity is directed backwards, and furnishes ramifications to the extensor brevis digitorum, the periosteum and the articulations of the tarsal bones. Its convexity, which is anterior, gives off three remarkable twigs, which are called *Dorsal Interosseous Arteries of the foot.* They direct themselves forwards in the second, third, and fourth interosseous spaces; and on arriving between the extremities of the metatarsal bones, communicate with the posterior perforating arteries of the external plantar. They then give twigs to the interossei dorsales muscles, over which they pass, and to the integuments, and communicate with the anterior perforating arteries, close upon the metatarso-phalangeal articulations. At the same level, each of them divides into two small branches which follow the corresponding edges of the toes, from the outer edge of the second to the inner edge of the last, and lose themselves in the skin.

2586. Immediately before diving into the first interosseous space, the dorsal artery of the foot gives off a pretty large branch which runs on the outer side of the first metatarsal bone as far as its articulation with the first phalanx of the great toe. There, this branch divides into two twigs, one of which runs along the outer edge of the first toe, while the other follows the inner edge of the second.

2587. Arrived in the sole of the foot, the dorsal artery turns outwards, between the accessory muscles of the flexor longus digitorum and interossei plantares, and separates into branches of equal size. One of them continues the course of the artery outwards, and contributes to form the plantar arch by anastomosing with the external plantar artery. The other follows the interval of the two first metatarsal bones between the abductor pollicis and flexor brevis pollicis muscles, to which it gives twigs, one of which, larger than the others, winds to the inner side of the great toe, and arrives at its extremity. The branch then passes through the flexor brevis muscle, and divides into two principal twigs, which subdivide and run along the corresponding edges of the two first toes.

OF THE FIBULAR OR PERONEAL ARTERY.

2588. Smaller than the posterior tibial, and situated very deeply at the back part of the leg, it directs itself a little obliquely outwards, from the end of the popliteal artery to near the malleolus externus, along the edge of the internal surface of the fibula. Its posterior side is covered by the soleus and flexor longus pollicis muscles. Resting above upon the tibialis posticus muscle, it passes through its fibres, and is placed below upon the interosseous ligament.

The twigs which it furnishes in the whole of this course are distinguished into external and posterior, and internal.

2589. *External and Posterior Twigs.* These are the largest. They descend obliquely in the soleus and gastrocnemii muscles, in which they lose themselves. Some of them are distributed to the integuments.

2590. *Internal Twigs.* They are much smaller and distributed in the tibialis posticus, flexor longus digitorum and flexor proprius pollicis. One of them, arising from the lowest part of the artery, directs itself transversely before the flexor muscles, and anastomoses with the posterior tibial.

2591. Near the malleolus externus, the fibular artery divides into two branches, which are the following :—

2592. *Posterior Fibular Artery.* It follows the original course of the artery, descends behind the inferior articulation of the fibula, and passes over the outer side of the calcaneum. It distributes numerous twigs to the tibialis posticus, flexores digitorum, peroneus longus and brevis muscles, the ankle joint, the tendo Achillis, &c. On the calcaneum, it separates into several twigs, which expand upon the outer, upper, and back part of the foot, and are distributed to the extensor brevis digitorum and abductor minimi digiti muscles, the integuments, and the surrounding adipose cellular tissue. One of them passes under the outer malleolus, and proceeds forwards to communicate with a twig of the anterior tibial artery (2580).

2593. *Anterior Fibular Artery.* It is sometimes wanting. When it exists, it perforates the inferior extremity of the interosseous ligament, passes under the peroneus tertius, to which it gives some twigs, descends upon the inferior articulation of the fibula with the tibia, bends forwards and inwards, and goes to anastomose with the anterior tibial, forming a small arch, from which proceed twigs in greater or less number, but generally of small size, and which immediately lose themselves in the neighbouring parts.

OF THE POSTERIOR TIBIAL ARTERY.

2594. Situated at the posterior part of the leg, but less deeply than the preceding, the *Posterior Tibial Artery* directs itself a little obliquely inwards, slightly flexuous, and then descends vertically between the two planes of the posterior muscles of the leg, as far as under the arch of the calcaneum, where it separates into two branches, which are the *Plantar Arteries.* It follows the course of a line extended from the middle of the calf to the posterior part of the inner ankle.

2595. In its two upper thirds, it is covered by the gastrocnemius and soleus muscles. In its lower third, it is placed along the inner side of the tendo Achillis, which at first covers it a little, but which afterwards leaves it only in relation with the tibial aponeurosis and the skin. Anteriorly, it corresponds to the interosseous space and to the tibialis posticus muscle; and at its lowest part rests upon the flexor longus communis digitorum, and corresponds to the posterior surface of the tibia. It is accompanied in its course by the internal popliteal nerve, which is placed at its outer side.

2596. In its course, the posterior tibial artery furnishes twigs of small size and indeterminate number. It sends very few to the gastrocnemius and soleus muscles, frequently none at all. They are almost all distributed laterally to the tibialis posticus and flexor muscles, the skin and the periosteum of the tibia. One of the latter is the *Nutritious Artery of the tibia*, the largest of the arteries of that kind. It descends upon the posterior surface of the bone in a groove which is observed there, and penetrates into the medullary canal, where it ramifies to infinity. Sometimes it comes from the trunk of the popliteal artery itself.

2597. When the posterior tibial artery has arrived under the arch of the calcaneum, and before dividing, it furnishes pretty large twigs to the periosteum of that bone, the adductor muscle of the great toe, the flexor brevis digitorum, the cellular tissue and the skin. Some, which are of smaller size, ascend upon the inner edge of the foot, and anastomose with those of the tibial artery.

OF THE INTERNAL PLANTAR ARTERY.

2598. Concealed at its commencement by the internal annular ligament of the tarsus, and of much smaller size than the external plantar, it passes horizontally forwards, along the inner part of the sole of the foot, passes under the flexor brevis pollicis, and ends in anastomosing by several twigs with the first collateral arteries.

2599. At its commencement, this artery gives numerous twigs to the ankle joint, adductor muscle of the great toe, flexor brevis digitorum, cellular tissue and integuments. Some of them, which are of considerable size, ascend above the muscles of the sole of the foot, and lose themselves in the lower part of the articulations of the tarsus.

2600. More anteriorly, the internal plantar artery gives twigs to the same muscles and to the flexor brevis pollicis. One of them, larger than the others, perforates the aponeurosis and is distributed to the skin. Several creep upon the inner side of the foot and anastomose with those of the dorsal artery of the foot.

OF THE EXTERNAL PLANTAR ARTERY.

2601. This ought to be considered as the true continuation of the posterior tibial artery. It separates from the preceding, directing itself obliquely downwards and outwards, in the groove of the calcaneum, and passes between the flexor brevis communis and accessorius muscles. It then proceeds forwards, in the interval that exists between the first of these muscles and the abductor minimi digiti, after which it bends inwards towards the posterior extremity of the fifth metatarsal bone to dive between the abductor pollicis and interossei muscles, and the posterior extremities of the metatarsal bones, describing a curve which brings it near the first of these bones, under which it anastomoses with the dorsal artery of the foot (2587). It thus forms with it the *Plantar Arch*, the concavity of which is directed backwards.

From the course which we have described it as following, it is easy to perceive that the external plantar artery forms a great curve, whose convexity corresponds to the outer part of the sole of the foot, and that the point at which it terminates is nearly opposite that at which it commences.

2602. Before forming the plantar arch, this artery gives twigs to the superficial muscles of the foot and to the integuments. One of them, which is of considerable size, descends vertically upon the inner part of the calcaneum, and is distributed to the origins of the adductor pollicis and flexor brevis digitorum muscles. The accessorius and abductor minimi digiti also receive twigs from it.

2603. The branches which arise from the plantar arch are distinguished into superior, posterior, and inferior, and anterior.

2604. *Superior Branches.* They are three in number, and pass vertically through the interosseous spaces, bearing the name of *Posterior Perforating Arteries.* They give at first twigs to the interossei muscles and to the periosteum of the metatarsal bones, and anastomose on the back of the foot with the interosseous twigs of the metatarsal artery (2585).

2605. *Posterior and Inferior Branches.* They are very small, and are distributed to the interossei and lumbricales muscles, the cellular tissue and the articulations of the tarsal with the metatarsal bones.

2606. *Anterior Branches.* These are the largest, and are commonly four in number. The first directs itself forwards and a little outwards under the flexor brevis minimi digiti, to which it gives numerous twigs, and terminates on the outer edge of the little toe. The second, third, and fourth, follow the last three interosseous spaces, giving twigs to the muscles which occupy them and to the lumbricales. Near the anterior extremity of the metatarsal bones, they enter above the transversus pedis, sending each over the back of the foot an *anterior perforating twig*, which communicates with those of the metatarsal artery (2585). Lastly, between the metatarso-phalangeal articulations, these branches separate each into two large twigs, which are distributed to the corresponding edges of the toes, from the inner part of the little toe to the outer part of the second, and which have exactly the same distribution as the collateral arteries of the fingers (2421).

III. *OF THE VEINS, OR VESSELS WHICH CARRY THE BLOOD FROM THE DIFFERENT PARTS OF THE BODY TO THE HEART.*

a. GENERAL REMARKS.

2607. The *Veins** *(Venæ)* are vessels destined to contain the dark blood, as the arteries contain the red. They occur in all parts of the body to which arteries are distributed; but they may be distinguished into two principal orders, two systems which are entirely separated from each other. One of these systems, which is much more extensive than the other, commences in all the organs by very minute radicles, and ends at the heart by the venæ cavæ. The other, which is confined to the cavity of the abdomen, commences in like manner by a great number of radicles in the digestive organs and spleen, and terminates in the liver by a single trunk which subdivides in its substance. This is called the *System of the Vena Portæ.*

2608. With respect to their general disposition, the veins may, in some measure, be compared to the arteries, but they differ essentially from them in respect to their number, situation, functions and organization.

2609. Their form is cylindrical like that of the arteries, and their caliber remains the same so long as they do not receive branches; but this cylindrical figure is interrupted from space to space by more or less remarkable contractions, which are owing to the presence of valves in their interior.

2610. Each artery is accompanied by at least one vein, which divides like it, has as many roots as it has branches, and whose size is much greater than that of the artery. There results from this that, at first sight, there seem to be as many veins as arteries; but the number is found to be much greater when it is observed that an artery is often accompanied by two veins of equal size with itself; that the roots of the veins also are more numerous than the branches of the arteries, and that many veins are entirely isolated from the arteries, as is observed under the integuments of the limb and trunk, in the brain, &c.

2611. The radicles of the veins unite successively so as to form trunks which become so much the larger the nearer they approach the heart; but as the sum of the diameter of all these radicles is much greater than that of the last trunks, there results that the venous system represents a cone whose summit is at the heart, while its base is at the circumference of the body. These radicles anastomose frequently together, and form net-works like those of the last ramifications of the arteries which give rise to them (2207). Sometimes also two principal venous trunks inosculate with each other.

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* Φλεψ of the Greeks.

2612. The walls of the veins are much thinner than those of the arteries, and have a grayish-white tint. They are formed of only two *coats*. The *outer* is loose, extensile, composed of longitudinal fibres more or less apparent, and more or less close. It is frequently surrounded by a sheath of cellular tissue, the lamellæ of which are placed very close upon each other. The *inner coat* is thin, smooth, and polished, having a considerable resemblance to that which lines the arterial tubes (2178), but never containing bony dots like those which are so frequently met with in the latter. This coat is prolonged into the right cavities of the heart and the sinuses of the dura mater, and by being folded in the veins, forms there a great number of semilunar valves precisely similar to those valves which we have seen at the commencement of the pulmonary artery and aorta.

These valves are sometimes isolated, more frequently disposed in pairs, but rarely three together. Their free edge is directed towards the heart, and is more or less concave. They are much more abundant in the veins of the inferior extremities than in those of the head or superior extremities. The system of the vena portæ is destitute of them. Their use evidently appears to be to prevent the blood from returning, by the veins, from the heart towards the circumference of the body, and their number is so much the greater the farther we remove from the heart.

2613. The coats of the veins, like those of the arteries, contain minute arteries and veins; but they are far from presenting so great a number of nervous filaments. The vena portæ is the only one in which a very apparent nervous plexus is observed (1818).

b. OF THE VEINS IN PARTICULAR.

1. *Of the Veins which concur in forming the Vena Cava Superior.*

a. OF THE VEINS WHICH GIVE RISE TO THE EXTERNAL JUGULAR VEIN.

2614. *Internal Maxillary Vein.* (*Veine gutturo-maxillaire,* Chauss.) It arises by a multitude of radicles in all the parts to which the artery of the same name is distributed (2235), excepting in the dura mater, for the middle meningeal artery is not accompanied by any vein. It is, therefore, composed of the *pterygoid*, *spheno-palatine*, *alveolar*, *infra-orbitar*, *mental*, *inferior dentar* and *deep temporal veins*, whose distribution is precisely the same as that of the arteries of the same name. By means of its spheno-palatine root, it communicates with the sinuses of the base of the skull. The small twigs which establish this communication pass through the foramina of that region, and are called like all those of the same kind, *Emissary Veins of Santorini*. Moreover, upon the sides of the pharynx, there are observed frequent anastomoses between the roots of the internal maxillary vein and the facial and pharyngeal veins. This disposition produces the *Pharyngeal Venous Plexus*.

Thus formed, the trunk of the internal maxillary vein passes behind the neck of the condyle of the lower jaw, and there unites with that of the superficial temporal vein.

2615. *Superficial Temporal Vein*. This vein, which is very flexuous, takes its rise in all the places where the corresponding artery is distributed, and its first radicles anastomose towards the top of the head with those of the opposite occipital, frontal, and temporal veins. It is composed of the middle temporal vein, the anterior auricular veins, the transverse vein of the face, and of some small twigs which come from the eyelids, eyebrow, prominence of the cheek, external auditory canal, and temporo-maxillary articulation. Thus formed, it descends before the ear, and unites with the preceding.

2616. The trunk which results from this union then dives into the parotid gland, which transmits some small twigs to it. It immediately furnishes a thick and short branch which passes deeply inwards, and opens into the internal jugular vein. The trunk then emerges inferiorly from the gland, and receives the following vein.

2617. *Posterior Auricular Vein*. It comes from the integuments of the mastoid region of the head, and from the inner surface of the concha of the auricle. One of its roots also is the *stylo-mastoid vein*, which issues from the aqueduct of Fallopius.

2618. This trunk then takes the name of *External Jugular Vein*. It is less voluminous than the internal, descends nearly vertically along the lateral and anterior part of the neck, placed at first between the sterno-cleido-mastoideus and platysma myoides, the latter of which alone separates it from the integuments, crossing the direction of the first, and pretty accurately corresponding with those of the fibres of the second. It then passes under the omo-hyoideus muscle, and is separated from the platysma myoides by a pretty thick layer of fat, so that in descending it becomes less and less superficial. Lastly, near the outer edge of the sterno-cleido-mastoideus muscle, it opens into the upper part of the subclavian vein, a little externally of the internal jugular vein. Sometimes it bifurcates at the moment of its termination; but always in its course along the neck it receives some veins, which are the following.

2619. *Cervical Cutaneous* and *Trachelo-scapular Veins*.

They are few in number above, and come from the muscles and teguments of the posterior region of the neck. But inferiorly and externally, the external jugular vein is augmented by several pretty large branches which arise from the muscles of the shoulder, follow the divisions of the superior and posterior scapular arteries, and traverse the triangular space which exists between the trapezius and sterno-cleido-mastoideus muscles. At the same point, that is to say, near the termination of the external jugular vein, and internally, there are seen opening other veins which follow the course of the clavicle, and whose roots, anastomosing with each other and with those of the opposite side, form between the skin and the sterno-hyoidei muscles above the superior extremity of the sternum, a venous plexus remarkable for the irregularity and number of its twigs. This plexus is farther augmented by four or five pretty large veins, which commence anastomosing with the facial veins, in the muscles of the superior hyoid region, descend vertically to the anterior and middle part of the neck, upon the sterno-hyoidei muscles, communicate frequently together, and receive branches which come from the lateral and superficial regions of the neck.

OF THE VEINS WHICH GIVE RISE TO THE INTERNAL JUGULAR VEIN.

(*Veine céphalique*, Chauss.)

2620. *Superior Cerebral Veins.* They are disseminated over the convex surface of the two hemispheres of the brain, from the substance of which they appear to issue by a multitude of very minute radicles placed towards the internal temporal fossæ. They have a very flexuous course in the anfractuosities, and direct themselves towards the great tissue of the hemisphere, uniting into trunks becoming successively larger, and no longer exclusively occupying the anfractuosities. Several of them, indeed, are seen passing transversely over the circumvolutions. The largest and most numerous are behind, and there are but very few before.

These trunks are joined near the median line, by similar trunks arising from the plain surface of the hemispheres, and after this union, they leave the brain, are enveloped by particular sheaths of the arachnoid membrane, and by bending gain the lateral and inferior parts of the superior longitudinal sinus (1475), into which they open obliquely, as we have said.

2621. *Vein of the Corpus Striatum.* Its roots are extended at the surface of the corpus striatum. It commences near the anterior extremity of the fornix, and turns obliquely outwards and backwards, in the groove which separates the optic thalamus from the corpus striatum, exactly following the course of the tænia semicircularis (1441) which covers it. It unites with the following.

2622. *Vein of the Choroid Plexus.* Its roots are found in the choroid plexus and tela choroides (1489). It winds over the optic thalamus, where it receives branches which descend from the fornix. Thus united, these two veins form to the right and left veins which are called the *Venæ Galeni.*

2623. *Venæ Galeni.* They direct themselves horizontally backwards in the tela choroides, placed in the canal which the pia mater forms by penetrating into the middle ventricle of the brain, and externally of that which the arachnoid membrane presents at the same place. They issue from the brain towards the posterior curve of the corpus callosum, and immediately introduce themselves into the right sinus of the dura mater by its anterior extremity (1478), crossing each other, so that the left goes to the right side of the sinus, and the right to the left side.

2624. *Superior Cerebellar Veins.* Arising from the substance of the cerebellum, and expanded over its whole upper surface, they unite into two or three trunks, which ascend obliquely forwards along the *processus vermiformis superior* (1414), bend upon themselves, leave the cerebellum, and penetrate into the straight sinus towards the middle of its length (1478). Some of these veins, which are smaller than the others, open into the venæ Galeni.

2625. *Inferior Cerebellar Veins.* Disposed nearly in the inverse direction of the preceding, and at the inferior surface of the cerebellum, they unite on each side into two or three trunks, which bend over the great circumference of the organ, and ascend vertically to open into the corresponding lateral sinus, at considerable distances from each other (1480).

2626. *Lateral and Inferior Cerebral Veins.* They are as numerous as the superior (2590), and have a similar disposition, but at the base and upon the sides of the brain. United, on each side, into three or four trunks pretty near each other, and enveloped by sheaths of the arachnoid membrane, they leave the brain together, direct themselves obliquely forwards and outwards, and open into the upper part of the lateral sinuses, behind the base of the petrous process, and passing through the fibrous bundles of the tentorium cerebelli.

2627. *Ophthalmic Vein.* It arises from all the parts contained within the orbit, from the pituitary membrane, the palpebræ, &c., and, in a word, from all the organs to which the ophthalmic artery is distributed.* The roots of the one have the same disposition as the twigs of the other (2258), and this vein is formed by the *Lachrymal Veins*, the *Central Vein of the Retina*, the *Infra-orbitar Vein*, the *Ciliary*, *Ethmoidal*, *Palpebral*, and *Nasal Veins.* We observe, however, that in the choroid membrane, the radicles of the ciliary veins form a distinct layer from those of the arteries (1862), and that they are so flexuous and anastomose so frequently together, that they receive the name of *Vasa Vorticosa.* Resulting from the union of all the veins which we have enumerated above, the ophthalmic vein passes out of the orbit by the inner part of the sphenoidal fissure, and discharges itself into the cavernous sinus (1432).

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* No veins have yet been discovered in the membrana pupillaris of the fœtus.

2628. The sinuses of the dura mater, charged with all the blood that returns from the brain, the eye, part of the nasal fossæ, &c. all terminate, as we have already said (1480), at the foramen lacerum posterius. There, the internal membrane of the veins ceases to be in immediate contact with the dura mater. There also commences the internal jugular vein, by a dilatation which is named the *Sinus of the Jugular Vein.* Commonly larger on the right side than on the left, and lodged in the jugular fossa, this dilatation is invested externally by the fibrous membrane of the veins (2582), and is separated from the vein properly so called by a contraction. The vein descends a little forwards, along with the internal carotid artery (2254), covered by the styloid process of the temporal bone, and by the muscles which are attached to it. It communicates at first with the external jugular vein, by a branch of large size (2586), and, a little before arriving at the level of the upper part of the arynx, it receives the facial vein.

2629. *Facial Vein* (*Veine palato-labiale*, Chauss.) This vein commences on the top of the head, and on the forehead, by a great number of roots which unite into a pretty large subcutaneous branch, having frequent anastomoses with that of the opposite side, descendng vertically upon the middle region of the forehead, and commonly named the *Frontal Vein* or *Vena preparata.* When this vein has arrived upon the sides of the root of the nose, it assumes the name of *Angular Vein*, receives anastomosing twigs from the ophthalmic, and is augmented by *Palpebral* and *Superciliary veins.* It is here that the *Facial Vein* properly so called commences. It descends under the integuments or levator labii superioris alæque nasi and orbicularis palpebrarum muscles, bends outwards, passes beneath the zygomaticus major at a considerable distance from the commissure of the lips, receives the *dorsal veins of the nose*, the *superior* and *inferior coronary veins of the lips*, and several *buccal* and *maseteric veins*, and directs itself towards the base of the jaw, without forming flexuosities like the artery to which it corresponds. It then directs itself obliquely downwards, backwards and outwards, between the platysma myoides and submaxillary gland, and on arriving at the internal jugular vein, after being augmented in the atter part of its course by the *ranine*, *submental* and *inferior Palatine veins.*

The first of these veins arises from the point of the tongue, descends along its inferior surface, follows the hypoglossal nerve between the mylo-hyoideus and hyo-glossus muscles, and discharges tself into the facial vein a little above the two following.

The second commences in the tongue and sublingual gland, by a branch which accompanies the sublingual duct, and which is preently augmented by other branches coming from the digastricus, platysma myoides and mylohyoideus muscles, and from the submaxillary gland. By their union, these branches constitute the trunk of the vein, which descends backwards between the body of the jaw and the anterior belly of the digastricus muscle, and opens into the facial vein or into the superior thyroid.

The third arises chiefly from the tonsils and velum palati, accompanies the inferior palatine artery, descends upon the sides of the pharynx, and receives some twigs which come from the pterygoideus internus and stylo-glossus muscles.

2630. After receiving the facial vein, the internal jugular is augmented by the lingual and pharyngeal veins.

2631. *Lingual Vein.* It arises particularly from a very complicated net-work, which is placed towards the base of the tongue, beneath the mucous membrane, between the epiglottis and the foramen cœcum (1971). It also receives many twigs from the tissue of the tongue, the sublingual gland, and the genio-glossus muscle. It anastomoses with the ranine vein, descends between the sublingual gland and the genio-glossus muscle, then enters the hyo-glossus and mylo-hyoideus muscles, and directs itself horizontally backwards and outwards before the latter, along the upper edge of the hyoid bone. It frequently unites with the pharyngeal before opening into the jugular.

2632. *Pharyngeal Vein.* It commences at the pharyngeal venous plexus, of which we have already spoken (2584), which is formed by the anastomoses of the two pharyngeal veins, of some emissary veins of Santorini, and of the internal maxillary veins. Its size is considerable. It opens into the jugular vein separately or along with the preceding.

2633. At the level of the upper edge of the larynx, the internal jugular vein receives the superior thyroid and occipital veins.

2634. *Superior Thyroid Vein.* It arises in the thyroid body by a multitude of roots which anastomose upon the upper edge o that organ with those of the opposite side, and which unite into a single trunk which passes between the sterno-thyroidei and sterno-hyoidei muscles, frequently receive the ranine and lingual veins, and always the *laryngeal vein*, which comes from the interior o the larynx, divides into two branches, and thus opens into the jugular vein by different points.

2635. *Occipital Vein.* Its roots exactly follow the course of th twigs of the occipital artery (2221), and unite into a single trunk which passes under the splenius muscle to open into the interna jugular vein, or into the external, but more rarely into the latter.

2636. *Veins of the Diploë.* They are situated in the substanc of the diploe of the bones of the skull, and lodged in particula canals. They commence by very delicate and very numerous capillary radicles, which form a kind of net-work upon the soft membrane which lines the areolæ of the diploe. By their successiv union, these original radicles form branches becoming larger an larger, in the interior of which are observed small valves, an which direct themselves towards the base of the skull. Th number and size of these principal branches vary much; bu in general one or two are found in the substance of the frontal bone, which discharge themselves into the frontal vein, two in the substance of the parietal bone, which open into the lateral sinuses of the dura mater and into the deep temporal veins, and one in the occipital bone, which opens into the occipital vein. From this arrangement, it is easy to judge that these vessels contribute to the formation of the internal jugular vein.

Moreover, it is to be remarked that the veins of the diploe have numerous anastomoses with each other, and that they communicate, internally and externally of the skull, by a multitude of *emissary* twigs, with the venous trunks which creep upon that part, or with the sinuses formed in the dura mater.

2637. After receiving all the branches mentioned above, the internal jugular vein forms a large trunk which descends vertically along the anterior and lateral part of the neck, behind the omohyoideus and sterno-cleido-mastoideus muscle, and the cervical branch of the hypoglossal nerve; before the rectus capitis anticus major, the vertebral column, the commencement of the subclavian artery and the scalenus anticus muscle, and externally of the common carotid artery and pneumo-gastric nerve. This vein opens into the sub-clavian, and presents on the right side the same direction as the vena cava superior, while on the left it forms a right angle with the subclavian.

2638. In this latter course, the internal jugular vein receives only a few cutaneous veins, and some branches which issue from the thyroid body under the name of *Middle Thyroid Veins.*

C. OF THE VEINS WHICH, BY UNITING, FORM THE SUBCLAVIAN VEIN.

2639. *Brachial Veins.* The collateral arteries of the fingers, the branches of the palmar arches, these arches themselves, the radial and ulnar arteries, and all their divisions, are accompanied each by two venous branches which exactly follow their course, and which become larger and larger as they ascend towards the elbow joint, where they form four principal and deep veins, which unite two and two, so as afterwards to constitute two large trunks. These run along the brachial artery, and embrace it at different points by anastomosing twigs, which they send off to each other. They receive in their course all the veins which accompany the divisions of the artery, as the *internal collateral vein*, the *deep humeral vein*, &c., and open into the axillary vein at the same place as the basilic.

2640. *Cephalic Vein (Veine Radiale Cutanée,* Chauss.) It commences by a great number of radicles, disposed in the form of a net-work on the back of the hand, and upon the muscles of the thumb. These radicles unite into a single trunk, which takes the name of *Cephalic Vein of the Thumb*, and bends inwards upon the muscles of the first interosseal space.

This trunk ascends along the anterior and external part of the fore-arm, where it forms the *Superficial Radial Vein.* It receives on all hands numerous subcutaneous twigs, and on arriving at the bend of the arm, unites with the *median-cephalic vein*, which ascends outwards in the triangular space formed in that place by the anterior muscles of the fore-arm, is larger than the superficial radial vein, and communicates with the median-basilic.

These two veins, thus united, form the trunk of the cephalic, which ascends vertically at the outer and fore part of the arm, along the external edge of the biceps muscle, at first under the skin, and afterwards under the cellular interval which separates the pectoralis major and deltoides. Then, bending inwards, under or above the clavicle, it opens singly, or divides into several branches, into the axillary vein, frequently communicating by a twig with the external jugular vein. In all this course it only receives a very small number of secondary veins.

2641. *Basilic Vein (Veine cubitale cutanée*, Chauss.) This vein, which is larger than the cephalic, is formed by three branches, which are named the *Posterior Ulnar*, *Anterior Ulnar*, and *Median-basilic Veins.*

The *Posterior Ulnar*, which is larger than the anterior, commences on the inner part of the back of the hand, and on the posterior surface of the fingers, by a net-work formed by a great number of radicles frequently anastomosing together, and with those of the cephalic veins of the thumb and superficial radial vein, and unites internally of the hand into a single trunk, named the *Vena salvatella.* This vein, ascending upon the inner part of the fore-arm, assumes the name of posterior ulnar. It receives in this course a great number of subcutaneous secondary veins, passes behind the inner condyle, and unites with the anterior ulnar vein.

The *Anterior Ulnar Vein*, commences in the inferior region of the internal and anterior part of the fore-arm, and ascends before the inner condyle. It communicates with the preceding by a great number of anastomosing twigs.

The *Median-basilic Vein* descends obliquely outwards along the tendon of the biceps muscle, and unites with the median-cephalic, sometimes at an acute angle, sometimes by a transverse branch. At the middle of this anastomosis two veins open. One of them is deep, and is formed by detached twigs of the deep radial and ulnar veins. The other is subcutaneous, and is called the *Common Median Vein.* The latter comes from a great number of roots expanded over the whole anterior surface of the fore-arm.

Thus formed by these different branches, the basilic vein ascends along the inner part of the arm, before the ulnar nerve, receiving but a small number of twigs, and anastomosing pretty frequently with the cephalic vein. It then throws itself deeply into the axilla, and is manifestly continuous with the axillary vein.

2642. *Axillary Vein.* This vein is, therefore, the result of the union of all those which we have examined in the hand, fore-arm, and arm, whether deep or superficial. It ascends obliquely inwards under the clavicle, always placed before the axillary artery, from the tendon of the pectoralis major to the inferior extremity of the scalenus anticus muscle.

In this course, it receives the *Circumflex Veins*, the *Inferior Scapular*, *Long Thoracic*, *Superior Thoracic*, and *Acromial Veins*, which correspond to the branches furnished by the axillary artery.

2643. To the axillary veins succeed the *Subclavian Veins*, which extend from the inferior extremity of the scalenus anticus muscle, before which they pass, to the vena cava superior, which they form by their union. Both proceed at first transversely inwards, and then bend downwards to enter the thorax. But they present differences according as they are examined on the right or on the left side, on account of the position of the vena cava superior.

Thus the right subclavian vein is very short, and approaches the vertical direction more in the second part of its course. It is covered by the sterno-cleido-mastoideus muscle, the sterno-clavicular articulation, the cartilage of the first rib, and a small portion of the sternum. It is applied externally and posteriorly against the right lamina of the mediastinum, the pneumo-gastric nerve, the right subclavian artery, and the scalenus anticus muscle. It corresponds internally to the aorta. Moreover, its size is always less than that of the left.

The latter is much longer and approaches the horizontal direction more than the right. It is also covered by the same parts, and, moreover, by nearly the whole length of the sternum, and by the muscles which are attached to it. It covers the scalenus anticus muscle, the left subclavian artery, the left lamina of the mediastinum, the pneumo-gastric nerve, the arch of the aorta, and the brachio-cephalic artery. It is also always larger than the right.

2644. The left subclavian vein receives two veins which the right does not receive. They are named the *Left Internal Mammary*, and the *Left Inferior Thyroid.*

2645. *Left Internal Mammary Vein.* Its roots are seen wherever the corresponding artery sends its twigs, and are collected into a single trunk which ascends backwards and outwards upon the posterior surface of the sterno-costal cartilages, and which open into the left subclavian vein, beside the superior intercostal. In its course, this vein is augmented by the superior diaphragmatic vein, and by the left mediastinal and thymic veins.

2646. *Left Inferior Thyroid Vein.* Its roots, on leaving the inferior part of the thyroid body, anastomose with those of the right inferior thyroid vein, and thus form, before the trachea, an arch into which open numerous twigs frequently anastomosing together, and expanded over the thyroid body and in the muscles which cover it. They communicate with the superior thyroid veins, and collectively constitute the *Thyroid Venous Plexus.*

From this plexus comes off the trunk of the vein, which runs at first transversely outwards, then descends obliquely upon the trachea, from which it is separated by much fat, upon the pneumogastric nerve, and the common carotid artery, and opens inferiorly and posteriorly into the left subclavian vein, which consequently covers it inferiorly.

2647. The two subclavian veins equally receive, besides the internal and external jugular veins; the *Vertebral* and *Superior Intercostal* veins.

2648. *Vertebral Vein (Veine cérébrale posterieure,* Chauss.) It commences in the muscles of the occipital and posterior cervical regions, by a great number of roots which collect into a single trunk towards the occipital foramen. This trunk directs itself forwards, above the atlas, penetrates into the foramen which occupies the base of the transverse process of that vertebra, and there communicates with the lateral sinus of the dura mater, by a twig lodged in the posterior condyloid foramen.

The vertebral vein then descends in the canal which lodges the vertebral artery (2298), communicating by each of the intervertebral foramina with the vertebral sinus, and receiving at the level of each intervertebral space a twig which comes from the muscles of the neck.

It issues from its canal at the sixth or seventh cervical vertebra, receives a branch which corresponds to the deep cervical artery (2323), and unites with another considerable vein, which commences upon the lateral region of the head, where it communicates with the lateral sinus of the dura mater by the mastoid foramen, and which descends before the transverse processes of the cervica vertebræ, sending numerous anastomosing twigs to the trunk of the vein itself, and receiving many twigs from the neighbouring muscles.

After this union, the vertebral vein descends, beside the artery between the rectus capitis anticus major and scalenus anticus muscles, passes on the left side before the subclavian artery, and on the right, behind it and the recurrent nerve, to open posteriorly and inferiorly into the subclavian vein.

2649. *Right Superior Intercostal Vein.* It is sometimes wanting, and is always smaller than the left. When it exists, it commences by branches distributed in the two superior intercosta spaces, and afterwards united into a single trunk, which issues from the thorax by its superior circumference, and opens posteriorly and inferiorly of the subclavian vein, near the vertebræ.

2650. *Left Superior intercostal Vein.* It is always larger and especially longer than the right. It commences in the eighth, seventh or sixth intercostal space, by some twigs which partly anastomose with the vena-azygos and vena semi-azygos, and ascends vertically behind the pleura, on the side of the bodies of the vertebræ, successively receiving branches from each intercostal space. Towards the third vertebra, it presents a slight curve, which receives three or four veins which descend from the first intercostal space. It then passes behind the lung and aorta, a little externally of the latter, and there, the *Left Bronchial Vein* discharges itself into it. After this it issues from the thorax and opens into the left subclavian vein.

OF THE TRUNK OF THE VENA CAVA SUPERIOR.

2651. Formed by the union of the two subclavian veins which carry all the blood of the head, superior extremities, and a portion of the thorax, the *vena cava superior* commences opposite the cartilage of the first rib, a little above the arch of the aorta, and descends to the left and forwards as far as the base of the pericardium, from which it receives a fibrous sheath more or less prolonged upon its walls. It then enters into that membranous sac, descends vertically to the right of the aorta, from which it is a little separated, is invested by the serous membrane of the pericardium, and opens into the right auricle of the heart, behind its free appendage, a little above the vena cava inferior, and confounded with the latter in a greater or less extent.

2652. The vena cava superior corresponds *anteriorly* to the thymus gland and cellular tissue of the anterior mediastinum; *posteriorly*, to the superior right pulmonary vein and aorta; to the *right*, to the lung; to the *left*, to the portion of the pericardium which ascends upon the aorta.

2653. Before penetrating into the pericardium, the vena cava superior receives the *Vena azygos*, *right internal mammary* and *inferior thyroid veins*, and several *thymic*, *mediastinal*, *pericardiac* and *superior diaphragmatic* branches, all from the right side.

2654. *Right Internal Mammary Vein.* It is precisely similar to the left (2645), differing from it only in its termination. Towards the umbilicus, its first root anastomose with those of the epigastric vein.

2655. *Right Inferior Thyroid Vein.* In the first part of its course, it is in all respects similar to the left, with which it constitutes the thyroid venous plexus (2646). But farther down, it descends outwards, between the pneumogastric nerve and the brachio-cephalic artery, which are behind, and the sterno-thyroidei and sterno-hyoidei muscles, which are before, and opens into the vena cava superior, between the two subclavian veins.

2656. *Vena Azygos*, (*Veine prélombo-thoracique*, Chauss.) It forms a communication between the two venæ cavæ. It opens into the vena cava superior, immediately above the right bronchus, forming around it and the right pulmonary artery, a kind of arch, by bending from before backwards, and a little from left to right. It then descends, directing itself slightly forwards and to the left, upon the fore part of the bodies of the dorsal vertebræ, alongside of the aorta and before the right intercostal arteries. It then penetrates into the abdomen, passing through the pillars of the diaphragm along with the aorta and thoracic duct, or sometimes to the outside of the right pillar. In the abdomen, it opens into the vena cava inferior or into one of the lumbar veins. Sometimes, at the moment of its termination, it bifurcates.

2657. Near its origin, the vena azygos receives, by the convexity of its curve, the *Right Bronchial Vein*, of which the roots extend into the lung and over the œsophagus, and some small twigs which come from the trachea, bronchial lymphatic ganglia, pericardium and walls of the aorta and pulmonary vein.

2658. In its course, along the dorsal vertebræ, the vena azygos receives *anteriorly* several twigs which come from the aorta and œsophagus. Some of the latter are very large, especially below. *To the right*, it receives the corresponding intercostal veins, which have the same distribution as the arteries of that name. *To the left*, towards the seventh rib, it receives the *Vena semi-azygos*, (*Veine, petite prélombo-thoracique*, Chauss.), a considerable branch commences, by anastomosing with the right renal vein or with the first lumbar vein, enters into the thorax by a particular aperture of the diaphragm, ascends parallel to the vena azygos on the left side of the vertebræ, and passes behind the aorta and œsophagus, receiving the inferior intercostal veins of the left side.

2. *Of the Veins which unite to form the Vena Cava Inferior.*

a. OF THE VEINS WHICH, BY THEIR UNION, FORM THE EXTERNAL ILIAC VEIN.

2659. *Popliteal Vein.* It commences deeply by three secondary veins, which have precisely the same course as the anterior and posterior tibial and fibular arteries. It is itself exactly similar to the artery whose name it bears, at the outer part of which it is situated, and which it afterwards covers posteriorly. It receives moreover a subcutaneous vein, which is the following.

2660. *External Vena Saphena* (*Veine peronéo-malleolaire* Chauss.) It commences by several roots expanded on the one hand, upon the back of the foot, and upon its outer side, and on the other, embracing the external malleolus, behind which they unite into a single trunk, which ascends obliquely, approaching the tendo Achillis, and afterwards directs itself vertically between the integuments and the union of the two heads of the gastrocnemius muscle, to place itself in the hollow of the ham, beside the internal popliteal nerve, and to open into the popliteal vein.

2661. *Femoral* or *Crural Vein.* This immediately succeeds the popliteal vein, and ascends obliquely at the inner and fore part of the thigh, close to the femoral artery, and following precisely the same course up to the crural arch (2586). It is at first placed behind the artery; but above it is in contact with its inner side. It receives a great number of deep branches, precisely similar to those of the artery, and a superficial branch, which is the following.

2662. *Internal Vena Saphena (Veine tibio-malléolaire,* Chauss.) Its first radicles occupy the inner edge of the great toe, and form on the back of the foot, near the metatarso-phalangeal articulations, a transverse arch which unites with the external saphena, and whose convexity, which is directed forwards, receives a certain number of twigs coming from the toes. All these roots united ascend before the maleolus internus, over the ankle-joint, and form a trunk which is further augmented by many branches which come from the tarsal and metatarsal regions. This trunk then ascends at first vertically, afterwards obliquely backwards, along the inner part of the leg, and passes behind the internal condyle of the femur. It then ascends almost vertically on the inner side of the thigh, before the adductores and gracilis muscles, and receives branches which come from the posterior and superficial part of the thigh. One of these branches is larger than the rest. It commences at the fore part of the leg, or around the inner condyle of the femur, by several roots of considerable size, some of which anastomose with the trunk of the vein itself. It then ascends obliquely between the skin and the fat, receiving many twigs from them.

The internal vena saphena then ascends as far as the crural arch, where it discharges itself into the femoral vein. There, it receives several *Abdominal Subcutaneous Veins*, a vein which corresponds to the circumflex iliac artery (2507), and the *External Pudic Veins.*

2663. *External Iliac Vein.* Placed beneath and a little internally of the artery of the same name (2502), this vein receives branches corresponding to those of the artery, and follows precisely the same course. The *Epigastric* and *Circumflex Iliac Veins* open into it. It receives moreover in the male a pretty large vein which enters by the inguinal ring, united to the spermatic cord, and which comes from the envelope of the testicle.

8. OF THE VEINS WHICH FORM THE HYPOGASTRIC OR INTERNAL ILIAC VEIN.

2664. The *Hypogastric Vein*, placed in the excavation of the pelvis, behind the artery of the same name, is composed of a number of branches corresponding exactly to those of the artery, with the exception of some which we proceed to describe.

2665. *Vesical Veins.* They are very numerous and of large size. They exhibit differences according to the sex of the subject in which they are examined.

In the male, they commence upon the glans by a great number of radicles which unite into two large trunks, the *Dorsal Veins of the Penis*, which run upon the back of that organ, accompanying the dorsal arteries (2500), and afterwards wind from above downwards at the exterior of the corpus cavernosum. There, these two veins subdivide into several secondary trunks, and unite with other veins which come from the substance of the scrotum and dartos, and from the external surface of the tunica vaginalis. They then proceed together, mingling with several branches of the internal pudic vein, to the roots of the corpus cavernosum, enter by the arch of the pubes, and continue their course horizontally on the sides of the bladder. After this they unite with new branches expanded over the prostate gland and the walls of the bladder, forming by their anastomoses a very extensive plexus with numerous meshes, and at length, collecting again into a few trunks, open into the internal iliac vein, near the obturator vein, receiving by the way some veins from the rectum and vesiculæ seminales.

In the female, the vesical veins commence by the *Dorsal Veins of the Clitoris*, and by a great number of roots spread out in the skin and cellular tissue of the labia. They unite around the vulva, and communicate with the internal and external pudic arteries. Several come from the constrictor vaginæ muscle, and the whole together form on the sides of the vagina and bladder a very remarkable plexus, from which proceed the last trunks of these veins. They receive by the way a great number of twigs placed behind the rectum and vagina, and between the latter and the bladder.

2666. *Sacro-Lateral Veins.* They communicate in the sacral canal, anastomosing with the vertebral sinuses, issue by the anterior sacral foramina, and direct themselves transversely before the sacrum to join the hypogastric. The inferior are larger than the superior.

c. OF THE COMMON ILIAC VEINS.

2667. They result from the union of the external iliac and hypogastric veins, and are of very large size. They arise opposite the sacro-iliac symphysis, and ascend from thence converging obliquely inwards, to the articulation of the bodies of the fourth and fifth lumbar vertebræ, where they unite to give rise to the vena cava inferior. The left passes successively under the left common iliac artery, then before the last vertebra, and, lastly, behind the right common iliac artery.

OF THE VENA CAVA INFERIOR OR ABDOMINALIS.

2668. It is much larger than the superior, and extends from the articulation of the fourth and fifth lumbar vertebræ to the right auricle of the heart, at the inferior and posterior part of which it opens, forming to a certain degree a common aperture with the vena cava superior.

It ascends at first vertically on the right lateral part of the bodies of the lumbar vertebræ, to beneath the liver, covered by the right common iliac artery, then by the peritoneum and duodenum, and placed to the right of the aorta. Opposite the liver its caliber frequently contracts a little, and sometimes, on the contrary, enlarges in a remarkable degree. It enters behind that viscus, describing a slight curve, the convexity of which is turned to the left. It then sometimes passes through an aperture which the liver presents to it; but, more commonly, is lodged in a notch formed between its right lobe and lobulus Spigelii. In the latter case, it corresponds to the middle and inferior part of the diaphragm.

Above the liver, the vena cava inferior introduces itself into the pericardium, passing through a wide aperture of the aponeurosis of the diaphragm (850). It directs itself a little obliquely to the left, backwards and upwards, then immediately enters the right auricle of the heart by an aperture which is bounded by the Eustachian valve (2151).

2669. The branches which the vena cava inferior receives in this course are the middle sacral vein, the lumbar veins, the right spermatic vein, and the renal, capsular, hepatic, and inferior diaphragmatic veins.

2670. *Middle Sacral Vein.* It ascends upon the middle part of the anterior surface of the coccyx and sacrum, and opens into the vena cava, in the angle formed by the union of the two common iliac veins.

2671. *Lumbar Veins.* They are four on each side, and commence each by an *abdominal branch* and a *dorsal branch*, corresponding to the branches of the lumbar arteries (2456). Their first roots anastomose with those of the last intercostal veins, and of the epigastric and circumflex iliac veins. The dorsal branches communicate, by the intervetebral foramina, with the vertebral sinuses. These branches unite and form a trunk which directs itself transversely, from without inwards, along the lumbar arteries, between the bodies of the vertebræ and the psoas muscle. The lumbar veins of the left side pass under the aorta, and are in consequence longer than the right. Before the vertebral column, those of the same side communicate with each other by means of several vertical twigs.

2672. *Spermatic Veins (Veines testiculaires ou veines de l'ovaire*, Chauss.) A little larger than the corresponding arteries, the spermatic veins differ in their origin in the different sexes.

2673. *In the male,* they commence by a plexus which is named the *Spermatic*, the roots of which are expanded in the testicle, and issue from it for the most part through the tunica albuginea, before the head of the epididymis. None of these roots pass from the epididymis to the testicle; only, towards the small extremities of the latter, a pretty large branch issues from the testicle, extends along the upper part of the epididymis, and contributes to form the plexus, the roots of which then become more numerous and larger, and anastomose with the roots of the dorsal veins of the penis, and of the vesical, internal pudic and other neighbouring veins. Afterwards, the plexus collects into four or five branches which ascend externally of the tunica vaginalis, enveloping the vas deferens, and anastomosing frequently with each other. These branches then pass through the inguinal ring, unite and form a single trunk which directs itself inwards and upwards, running along the psoas muscle, as far as the upper part of the pelvis.

There, the spermatic veins divide a second time to form another plexus under the kidney. This plexus has been named the *Corpus pampiniforme.* It is augmented by a great number of *Adipose veins*, which come transversely from the mass of fat which surrounds the kidneys, and which communicate frequently together. Some of its twigs also come from the mesocolon and mesentery, where they anastomose with those of the vena portæ.

Above the corpus pampiniforme, the spermatic veins unite again, ascend obliquely inwards between the peritoneum and psoas muscle, and open, the right into the vena cava, under the renal vein, the left into the corresponding renal vein.

2674. *In the female*, the spermatic veins derive their origin from a plexus expanded in and upon the ovarium, and of which several roots come from the sides of the uterus, where they anastomose with the uterine veins. They are afterwards joined by some branches which arise from the ligamentum teres and Fallopian tube. These different branches collect between the two laminæ of the broad ligament of the uterus, pass over the external iliac artery, crossing its direction, bend outwards, gain the brim of the pelvis, and after this exhibit the same appearances as in the male.

2675. *Renal* or *Emulgent Veins.* They are of great size. Their roots correspond exactly to the last ramifications of the renal arteries, in the substance of the kidneys. They unite in the fissure of the organ into several converging branches, which collect into a single trunk before the artery. The trunk directs itself transversely inwards, and opens upon the sides of the vena cava. The left renal vein is commonly larger and longer than the right, which presents a slight obliquity.

In their course, the renal veins receive some capsular and adipose twigs. The left is moreover augmented by the corresponding spermatic vein.

2676. *Capsular Veins.* There is one on each side. They frequently open into the renal veins, and in other respects have precisely the same disposition as the arteries to which they correspond.

2677. *Hepatic Veins.* They have their roots in the substance of the liver, where they are enveloped by a prolongation of the fibrous capsule of that organ. Some of them of small size and irregular, enter the vena cava separately. Others, the *Middle Hepatic Veins,* to the number of two or three, come from the lobulus Spigelii of the liver, and open into the vena cava between the right and left hepatic veins.

The *Left Hepatic Veins* come from the left lobe of the liver, where they are ramified to infinity, and issue near its free edge and not far from its left lateral ligament. They enter into the vena cava before and opposite the aperture of the diaphragm, through which it passes.

The *Right Hepatic Veins* issue from the right lobe of the liver about the middle of its inferior surface, direct themselves transversely to the left, and open into the vena cava much below the preceding.

2678. *Inferior Diaphragmatic Veins.* They are two in number, and are precisely similar to the arteries of the same name (2416).

OF THE VERTEBRAL VENOUS SINUSES, AND VEINS OF THE SPINAL MARROW.

2679. In the whole length of the vetebral canal, from the great occipital foramen to the extremity of the sacrum, behind the bodies of the vertebræ, before the dura mater, and on the sides of the posterior common vertebral ligament, there prevail two great venous canals entirely different from the sinuses of the dura mater, and which are named *Vertebral Sinuses.*

At the level of the anterior condyloid foramina, these sinuses communicate each by a twig with the corresponding internal jugular vein, without having any kind of connection with the sinuses of the dura mater. Their caliber is always in the inverse ratio of the greater or less development of the posterior vertebral ligament. Thus, in the neck, where it is broad, they are narrow, and in the back they increase in capacity because it contracts. They are in general more developed upon the bodies of the vertebræ than opposite their fibro-cartilages, which is especially observable in the lumbar region, where they present very distinct successive contractions.

Considered with reference to their interior, these sinuses have the same disposition as those of the dura mater; in other words, they are traversed in various directions by irregularly distributed membranous bridles.

By their inner side, they communicate with each other by means of prolongations which form true *transverse sinuses,* constantly occupying the middle of the body of each vertebra, passing under the posterior vertebral ligament, and receiving by their middle and anterior part, the veins which arise in the spongy tissue of the vertebræ.

By their outer side, the vertebral sinuses communicate with the posterior branches of the vertebral (2618), intercostal (2619) and lumbar (2641) veins, in the interval of the transverse processes.

By their posterior side, they receive the very numerous and very slender veins which creep upon the dura mater that envelopes the spinal marrow.

2680. In the sacral canal, the vertebral sinuses become much diminished, and change their appearance. Here they are only cylindrical veins of considerable size, immersed in an adipose cellular tissue, and have no adhesion to the osseous parts. Their inferior extremity is a very delicate twig, which is lost in the fat. Externally they form anastomoses with the lateral sacral veins (2636); and, internally, send transverse twigs of communication to each other.

2681. The veins of the spinal marrow have the same disposition as the arteries of that name. They accompany them, and open into the inferior cerebellar veins.

3. *Of the Cardiac Veins or Coronary Veins of the Heart.*

a. RIGHT CORONARY VEINS.

2682. *Great Right Coronary Vein.* It commences towards the summit of the heart by several radicles which anastomose with those of the small right coronary vein and of the left coronary veins. It then ascends in the adipose groove of the thick edge of the heart, accompanying a branch of the corresponding coronary artery. It receives a great number of lateral twigs, turns over the blunt edge of the heart, passes into the groove which separates the auricles from the ventricle, becomes horizontal, and directs itself to the right and upwards.

2683. *Small Right Coronary Vein.* It arises like the preceding, passes into the groove of the posterior surface of the heart, receives the veins of that surface and of the septum of the ventricles, ascends vertically upon the wall of the auricle, and unites with the preceding.

b. LEFT CORONARY VEINS.

2684. They are much smaller than the right, and vary much in respect to number. They commence along with the preceding at the summit of the heart, by several roots which unite upon the convex surface of that organ into two or three branches. These often collect into a single trunk which ascends vertically over the groove which separates the ventricles from the auricles, and open along with the others at the posterior part of the right auricle, under the vena cava inferior.

4. *Of the System of the Vena Portæ.*

a. ORIGIN OF THE VENA PORTÆ.

2685. The *Vena Portæ* derives its origin from all the organs contained in the cavity of the abdomen, excepting the kidneys and bladder, and the uterus in the female. But these origins unite to form two principal trunks, which are called the splenic and superior mesenteric veins.

2686. *Splenic Vein.* It arises from the spleen by a number of branches varying from three or four to seven or eight, which, after a short course, unite upon the pancreas into a single trunk. Less flexuous than the artery which it accompanies, the splenic vein then directs itself transversely from left to right and beneath it, before the pancreas, to unite with the superior mesenteric, opposite the vertebral column. In its progress, it receives the veins which correspond to the *vasa breviora* (2429), in which M. Bauer has very recently (September 1820), discovered true valves which I also once observed: the *right and left Gastro-epiploic veins*, the *Duodenal* and *Pancreatic Veins*, the *Coronary Vein of the Stomach*, and the *Small Mesaraïc* or *Mesenteric Vein.*

The last-mentioned vein receives the blood of the left part of the arch of the colon, and of the descending colon and rectum. Its roots correspond to the immediate branches of the inferior mesenteric artery, of which it even accompanies the trunk to above the sigmoid flexure of the colon. It then leaves it, ascends vertically behind the peritoneum of the left lumbar region, passes between the transverse mesocolon and the vertebral column, enters beneath the pancreas, and joins the splenic vein nearly at a right angle.

2687. *Superior Mesenteric* or *Great Mesaraïc* vein. Its disposition is almost precisely the same as that of the artery of the same name (2430), to the right and a little anteriorly of which it is placed. It is formed by all the veins of the small intestine, and by three veins which correspond to the three right colic arteries, and which are designated by the same name. Its roots constitute, in the substance of the mesentery, a net-work similar to that of the ramifications of the artery. On arriving at the attached edge of the transverse mesocolon, its trunk enters beneath the pancreas, and unites with the splenic vein at a right angle, after receiving several duodenal and pancreatic veins.

b. OF THE TRUNK OF THE VENA PORTÆ AND ITS DIVISIONS.

2688. The trunk of the vena portæ results from the junction of the splenic and superior mesenteric veins: but its diameter is much smaller than the sum of the diameters of these two veins. It ascends obliquely to the right, and has about four inches of extent from the vertebral column, where it commences, to the groove of the liver, where it terminates. Lying at first under the small extremity of the pancreas and behind the second portion of the duodenum, the vena portæ, united to the biliary vessels, and covered by the hepatic artery and cystic and hepatic ducts, surrounded by a great number of nervous filaments and lymphatic vessels, arrives near the right extremity of the transverse groove of the liver, and bifurcates. Its two branches separate nearly at a right angle, and seem to form under the liver a horizontal canal which some anatomists have called the *Sinus of the Vena Portæ.* They are both united to the two divisions of the hepatic artery. The right, which is not so long as the left, but larger, introduces itself into the great lobe of the liver, and ramifies to infinity in its interior. The left, which is smaller and longer, proceeds horizontally as far as the ligament of the umbilical vein, and divides in the left lobe. It throws a principal branch into the lobulus Spigelii.

2682. All the branches of the vena portæ are surrounded in the liver by a prolongation of the fibrous capsule of that organ. This is what was long designated by the name of *Capsule of Glisson.* We are unacquainted with the uses of this envelope, which equally belongs to the other vessels that are distributed to the liver, and which some have supposed to be of a muscular nature.

2690. Injections made by the vena portæ penetrate into the other vessels of the liver, and *vice versa.*

CLASS SECOND.

ARTICLE FOURTH.

ORGANS OF ABSORPTION.

I.—GENERAL OBSERVATIONS.

2691. The *Organs of Absorption* are arranged into two perfectly distinct orders. The *Lymphatic* or *Absorbent vessels,* and the *Lymphatic Ganglia.* The latter are also frequently named *Lymphatic* or *Conglobate Glands.*

2692. The *Lymphatic Vessels* are extremely numerous. Arising from the surface of the membranes and from the tissue of the organs, they transmit all the absorbed fluids to the venous system. Those which take up the chyle during the process of digestion in the intestines constitute a separate order, known by the name of *Chyliferous* or *Lacteal Vessels* or simply *Lacteals.* Although they differ in their uses from the other lymphatic vessels, they have precisely the same organization and anatomical disposition.

2693. Lymphatic vessels occur in all parts of the body; but in whatever parts they are examined, they form two distinct planes, a superficial and a deep-seated. Thus, the whole exterior of the body is covered by a net-work of these vessels placed in the subcutaneous cellular tissue, while others occupy the intervals of the organs. This disposition is not confined to the limbs only, where it is more easy to observe it, but exists in each particular organ, the liver, lungs, pancreas, &c. We also observe that the superficial absorbents are distributed in a uniform manner, while the deep-seated unite into bundles around the blood-vessels, whose direction they exactly follow. But these planes communicate frequently together by numerous anastomosing twigs, and even entirely unite to form common plexus, as is observed at the upper part of each limb.

2694. The lymphatic vessels are much smaller than the arteries or veins. Their caliber varies much, according to the state of the subject in which they are examined. Thus in subjects whose cellular tissue is drenched with serous fluids, they are much more apparent. The disproportion between the size of the roots and that of the trunks is still greater than in the blood-vessels.

2695. The lymphatic vessels are in general cylindrical; but they present at intervals dilations of greater or less size, which give them a knotted appearance, and which are owing to valves placed in their interior.

2696. In general, they are more or less straight in their course; but their anastomoses are excessively numerous. They frequently cross each other, forming successive plexus. Another still more remarkable fact, is the frequency of their alternate unions and divisions, so that a great number of twigs, after being collected into a single trunk, separate a second time, and again form one or more trunks.

2697. The disposition and nature of the extreme roots of the absorbent vessels are entirely unknown.

2698. Before terminating in their principal trunks, the branches of the lymphatic trunks have to traverse a greater or less number of *Lymphatic Ganglia,* that is to say, small organs of variable form and size, collected together in greater or less quantity, or isolated. These ganglia are not very numerous along the limbs; but they occur abundantly in the abdomen and thorax. Each of them receives one or more lymphatic vessels by one of its sides. These vessels subdivide to infinity in its substance or at its surface, without our being able to say precisely in what manner, and there are seen issuing from the opposite side, other lymphatic vessels, which are termed *efferentia*, to distinguish them from the first, which are designated by the name of *deferentia* or *afferentia*. There result numerous subdivisions of both kinds of vessels around the ganglion, forming a true circular plexus, which embraces it on all sides.

The lymphatic ganglia vary in diameter from the twentieth part of an inch to a whole inch. Their colour is in general reddish, sometimes, however, gray or blackish. Those which are situated at the exterior have a more solid and denser tissue than those which are met with in the splanchnic cavities. They are all enveloped by a compact membrane, externally glistening, and furnished with some blood-vessels.

They receive numerous small arteries. These issue from their corresponding veins; and these vessels throw ramifications upon the walls of the neighbouring lymphatic vessels themselves.

They appear chiefly formed by an inextricable interlacement of these lymphatic vessels.

2699. All the absorbent vessels of the body discharge themselves, by some trunks, into the subclavian and internal jugular veins. Two of these trunks are much larger than the others, and are designated by the names of *Thoracic Duct* and *Great Right Lymphatic Vein.* The former receives the lymphatics of the abdomen, the inferior extremities, the left side of the thorax, the left superior extremity, and the corresponding side of the head and neck. The other receives those of the right arm, and of the right side of the head, neck, and thorax.

2700. With reference to their structure, the lymphatic vessels appear formed of a cellular external membrane, and an internal membrane similar to that of the veins. The latter, by being folded upon itself, produces at intervals valves which are generally disposed in pairs.

II.—OF THE LYMPHATIC GANGLIA IN PARTICULAR.

1. OF THE LYMPHATIC GANGLIA OF THE INFERIOR EXTREMITIES.

2701. *Anterior Tibial Ganglion.* It is the only one that occurs along the leg. It is placed between the tibia and fibula, on the lower extremity of the interosseous ligament.

2702. *Popliteal Ganglia.* They are of small size, and are situated in the ham, to the number of three or four. They are concealed by the aponeurosis, and surrounded by the popliteal artery.

2703. *Inguinal Ganglia.* They occupy the anterior and superior part of the thigh near the groin, and are distinguished into *superficial* and *deep*. The former are placed between the skin and aponeurosis, and surround the internal saphena vein, near its termination, their number varies from eight to eleven, and they are sometimes seen to commence near the middle and inner part of the thigh, and to form a string extending to the groin. Their colour is red in children, of a grayish white in adults, and brownish in old people.

The deep inguinal ganglia, to the number of two, three, or four, are placed under the aponeurosis, and around the femoral artery. They are often wanting in old persons.

2. OF THE LYMPHATIC GANGLIA OF THE PELVIS.

2704. *Hypogastric Ganglia.* They occupy, to the number of ten or fifteen, the lateral parts of the excavation of the pelvis, and are spread out around the internal iliac vessels.

Very small lymphatic ganglia are frequently met with on the outside of the pelvis, in the course of the glutæal and ischiatic arteries, or in the interior of that cavity upon the bladder, the uterus, or the vesiculæ seminales.

2705. *Sacral Ganglia.* They are placed before the sacrum, in the substance of the mesorectum, and are continuous laterally with the preceding, and above with the mesocolic ganglia.

2706. *External Iliac Ganglia.* Their number varies from six to ten, twelve or fifteen. They are situated along the course of the external iliac vessels, and form a cord from the crural arch to the lower part of the vertebral column, where they are continuous with the lumbar ganglia.

3. OF THE LYMPHATIC GANGLIA OF THE ABDOMEN.

2707. *Lumbar Ganglia.* They are very numerous and of large size, and occupy the sides of the lumbar region of the vertebral column, placed between the transverse processes or in the course of the vessels, or surrounding the aorta and vena cava inferior. They ascend upon the crura of the diaphragm, and furnish the principal roots of the thoracic duct. Some other ganglia, scattered over the renal arteries, seem to unite with them.

2708. *Hepatic*, *Pancreatic*, and *Splenic Ganglia.* They are situated around the vena portæ, and along the splenic artery. They receive the lymphatic vessels of the liver, aorta, and pancreas.

2709. *Mesenteric Ganglia.* Very numerous, and in general of considerable size, they are placed between the two laminæ which constitute the mesentery. Their number, which is excessively variable, much exceeds a hundred. Their position is very irregular; but from the intestine to about an inch from its concave edge, none are met with. Their size is so much the greater, the nearer they are observed to the place where the mesentery is in contact with the vertebral column, These ganglia immediately receive the absorbents of the chyle.

2710. *Mesocolic Ganglia.* Much less numerous than the preceding, and placed between the laminæ of the mesocolon, they are distributed along the colon, and are more numerous in its transverse than in its lumbar or iliac portions. They are situated near its concave edge. Some of them, which are smaller than the rest, are even disseminated over its two surfaces.

2711. *Gastro-epiploic Ganglia.* They occupy the two curvatures of the stomach, and surround the gastro-epiploic arteries and the coronary artery of the stomach. They are not numerous, there being only five or six for each curvature.

4. OF THE LYMPHATIC GANGLIA OF THE THORAX.

2712. *Ganglia of the Mediastinum.* There are observed three or four upon the diaphragm, and about the same number are distributed upon the pericardium in the inferior separation of the posterior mediastinum; but twelve or fifteen at least surround the thymus gland and the large vessels of the base of the heart.

2713. *Ganglia of the Walls of the Thorax.* They are irregularly scattered between the two layers of the intercostal muscles. Twelve are also met with on each side of the vertebral column on the articulations of the ribs. Some are placed near the œsophagus and aorta in the posterior mediastinum. Lastly, there are eight or ten on each side which mark the course of the internal mammary arteries.

2714. *Bronchial Ganglia.* These we have already described. (2129).

5. OF THE LYMPHATIC GANGLIA OF THE SUPERIOR EXTREMITIES.

2715. *Ganglia of the Arm.* They are distributed in the course of the brachial artery, from the bend of the arm to the axilla. They are scarcely ever met with in the fore arm. Not unfrequently there is one at the bend of the arm, near the inner condyle.

2716. *Axillary Ganglia.* They are of large size, and vary in number. They are placed in the axilla, between the pectoralis major, serratus magnus, latissimus dorsi and subscapularis, around the axillary vessels and their branches, and in the midst of the cellular tissue. Some are met with under the clavicles and between the pectoralis major and the ribs.

6. OF THE LYMPHATIC GANGLIA OF THE HEAD AND NECK.

2717. *Ganglia of the Skull.* No lymphatic ganglia are met with in the interior of the skull. The outside of that cavity presents only two or three small ones behind the ear, upon the outer surface of the parotid gland. One or two are also observed behind the zygomatic arch.

2718. *Ganglia of the Face.* These occur only in small number. A few are observed upon the buccinator muscle. The others prevail along the base of the jaw, and surround the anterior belly of the digastric muscles.

2719. *Ganglia of the Neck.* They are *superficial* or *deep.* The former are irregularly disposed beneath the platysma myoides, in the course of the external jugular vein and its branches. The others *(glandulæ concatenatæ)* occur in the vicinity of the internal jugular vein and common carotid artery. Their number is very great, but their size is small. They form a kind of knotty cord, from the mastoid process to the superior orifice of the thorax, and are prolonged backwards between the pharynx and vertebral column.

III.—*OF THE LYMPHATIC VESSELS IN PARTICULAR.*

A.—OF THE LYMPHATIC VESSELS WHICH TERMINATE IN THE THORACIC DUCT.

1. OF THE SUPERFICIAL LYMPHATIC VESSELS OF THE INFERIOR EXTREMITIES.

2720. They arise from the toes by very delicate radicles, which at the base of each phalanx form a net-work, from whence proceed twigs which cover the two surfaces of the foot. Those of the upper surface, *(Rames sus-plantaires,* Chauss.) form, by their successive union, from sixteen to twenty branches, which almost all gain the inner edge of the leg, where they meet the internal saphena vein. Those of the inferior surface, *(Rames plantaires,* Chauss.) collect towards the heel, and form two or three branches around the tendo Achillis.

2721. The first ascend along with the internal saphena vein upon the anterior and internal sides of the leg. Some of them run upon its outer side, accompanying the external saphena vein; but at different heights, and especially near the knee, bend forwards and inwards, and anastomose with those of the inner side. A very small number also bend in the same manner behind the knee; and in general, all the lymphatics which arise upon the back of the foot, and along the anterior surface of the leg, occur collected at the inner part of the thigh, above the patella.

2722. Those which come from the sole of the foot and from the posterior surface of the leg ascend around the tendo Achillis, anastomosing inwards and outwards with the preceding. They then envelope the calf, and near the ham unite with the others after bending inwards.

2723. Thus united, all the superficial absorbents of the leg ascend along the inner and outer side of the thigh, approaching each other, and continually anastomosing, and at length terminate in the superficial inguinal ganglia.

But, in their course, they are accompanied and augmented by other vessels of the same nature, arising particularly upon the fore part of the thigh, and by others, in smaller number, which come from its posterior region.

2724. All these vessels are so numerous, and their anastomoses so frequent, that they form a net-work upon the foot, leg and thigh, which completely surrounds these parts. They are immersed in the subcutaneous cellular tissue.

2. DEEP LYMPHATIC VESSELS OF THE INFERIOR EXTREMITIES.

2725. They follow the course of the blood-vessels, and may be distinguished into four kinds, according as they accompany the external saphena vein, or the anterior and posterior tibial and fibular arteries.

2726. Those which accompany the external saphena vein are two or three in number. They originate by a multitude of radicles on the outer part of the back and sole of the foot. All these radicles unite towards the outer malleolus, under the aponeurosis, and the two vessels which result from this union ascend along the outer edge of the tendo Achillis, where they receive some twigs which come from that tendon. They then place themselves between the heads of the gastrocnemius muscle, which also affords them several branches, and arrive in the ham, where they successively divide in the popliteal ganglia, to unite partly with the other deep absorbents, and partly with the superficial, in the latter case perforating the aponeurosis.

2727. *Anterior Tibial Lymphatics.* These are also two in number. One of them has its roots in the sole of the foot, around the plantar arch; the other originates upon the outer part of the back of the foot. The first ascends upon the back of the foot along the dorsal artery (2551), between the first two metatarsal bones, whence it passes between the anterior muscles of the leg, to terminate in a small ganglion near the upper extremity of the interosseus ligament at the posterior surface of the leg, where it unites with the other deep vessels. The second follows the same course as far as the middle third of the leg, where it traverses the interosseous ligament to unite with the fibular absorbents.

2728. *Posterior Tibial Lymphatics.* They originate deeply in all parts of the sole of the foot, and form several trunks which ascend along with the posterior or tibial artery, which they embrace on all sides as far as the popliteal ganglia.

2729. *Fibular Lymphatics.* They arise in like manner from the sole of the foot, follow the course of the fibular artery, and terminate in the popliteal ganglia.

2730. All the deep lymphatic vessels of the leg and foot thus terminate in the popliteal ganglia, which are united together by a great number of short lymphatic vessels, which there form a true plexus, whence issue two, three, or four trunks, which ascend along the popliteal vessels, pass through the insertion of the adductor magnus muscle, follow the femoral vessels, receiving all the deep lymphatics of the thigh, and subdividing up to the deep inguinal ganglia, where they terminate. Some of them go to the first external iliac ganglia.

3. SUPERFICAL LYMPHATIC VESSELS OF THE HIPS, PERINÆUM, LOINS, EXTERNAL PARTS OF GENERATION, &c.

2731. *Lymphatics of the Hips.* They are immersed in a great quantity of cellular tissue, and communicate frequently together. They bend over the outer and inner parts of the thigh, to unite with the superficial absorbents and those of the perinæum, and terminate at the superficial inguinal ganglia.

2732. *Lymphatics of the Loins.* They come from the posterior and lateral parts of the vertebral column, behind which those of one side communicate with those of the opposite. They then descend above the iliac crest, and divide in the superficial inguinal ganglia.

2733. *Lymphatics of the lower half of the Walls of the Abdomen.* Their roots, which anastomose frequently together, commence at the level of the umbilicus, and form a net-work over the whole anterior region of the abdomen. They unite inferiorly into a few trunks which terminate in the superficial inguinal ganglia.

2734. *Lymphatics of the Perinæum, Scrotum, and Penis.* Those of the scrotum are very numerous. They ascend on each side to the inner part of the thigh, where they unite with those of the perinæum and penis. The latter form two distinct bundles upon the lateral parts of the penis, and subdivide to unite with the others, as well as with a single lymphatic which runs along the back of the penis, and bifurcates towards its root. They all terminate together in the superficial inguinal ganglia.

2735. In the female, the lymphatics of the labia pudendi and clitoris have the same termination.

4. DEEP OBTURATOR, ISCHIATIC, GENITAL, &c., LYMPHATIC VESSELS.

2736. *Obturator Lymphatics.* They arise from the adductor muscles and neighbouring parts, and ascend along with the obturator artery, through the obturator foramen, to end in the hypogastric ganglia.

2737. *Ischiatic Lymphatics.* Their roots are distributed in the gemelli, pyramidalis, quadratus and glutæus maximus muscles. They follow the ischiatic artery, and terminate within the pelvis, in the hypogastric ganglia.

2738. *Glutæal Lymphatics.* They commence in the three glutæi muscles, pass along with the glutæal artery through the great sciatic notch, enter within the pelvis, and end in the hypogastric ganglia, along with some small vessels arising deeply from the anus and perinæum.

2739. *Deep Lymphatics of the Penis and Clitoris.* They follow the course of the internal pudic artery (2492) and terminate in the hypogastric ganglia.

2740. *Lymphatics of the Testicle.* They are very numerous and of great size in the adult. Arising from the coats and substance of the testicle and epididymis, they unite upon the spermatic cord into a number of branches varying from six to twelve, and which ascend along with it, anastomosing very little, towards the inguinal ring, through which they pass to follow the spermatic artery and terminate in the lumbar ganglia.

2741. *Lymphatics of the Prostate Gland and Vesiculæ Seminales.* They unite in part with those of the bladder, and throw themselves into the hypogastric ganglia.

2742. *Lymphatics of the Uterus.* They are of large size at the period of gestation, but appear very small during the empty state of the uterus. They arise from the surface, or in the substance of that organ, and unite with those which come from the vagina, to terminate in the hypogastric ganglia. The highest prolong themselves upon the broad ligament, and unite with those of the ovarium. The latter are very numerous, and form a kind of plexus. They ascend together, along with the spermatic vessel, toward the lumbar ganglia.

5. LYMPHATIC VESSELS OF THE URINARY ORGANS.

2743. *Lymphatics of the Bladder.* They arise from the whole extent of that organ, follow the course of its vessels, and open into the hypogastric ganglia.

2744. *Lymphatics of the Kidneys.* They are generally very small, and may be divided into *superficial* and *deep.* Their roots anastomose in the tissue of the organ, and their trunks unite towards its fissure. They then proceed, upon the sides of the aorta, to end in the lumbar ganglia.

The ureters are also surrounded by a great number of lymphatics which ascend upon them anastomosing together.

2745. *Capsular Lymphatics (V. Lymphatiques surrenaux,* Chauss.). They come from the supra-renal capsules, anastomose frequently together, and unite in part with those of the kidneys. Some of those of the right side terminate in the hepatic ganglia.

Several of those of the left side end in the splenic ganglia, or in those which cover the corresponding pillar of the diaphragm.

6. LYMPHATIC VESSELS OF THE WALLS OF THE PELVIS AND ABDOMEN.

2746. *Ilio Lumbar Lymphatics.* They originate in the substance of the iliacus muscle, and upon the iliac bone, uniting afterwards into two trunks which pass under the psoas muscle, and subdivide again to terminate partly in the inferior lumbar ganglia, and partly to contribute to the formation of the *External Iliac Lymphatic Plexus*, or the assemblage of lymphatics which accompany the external iliac vessels, passing from one ganglion to the other, and anastomosing thousands of times with each other.

2747. *Sacral Lymphatics.* These arise from the adipose tissue in which the rectum, sacral nerves, and pyramidalis muscle are immersed. Some of them issue from the sacral canal by the anterior sacral holes, and all terminate in the inferior lumbar or hypogastric ganglia. Those which go to the latter contribute to form the *Hypogastric Lymphatic Plexus*, which, like the external iliac plexus, is constituted by an intertexture of vessels and ganglia, and is placed upon the sides of the pelvis. It is in it that the obturator, glutæal, ischiatic, uterine and vesical lymphatics terminate. Externally, it is continuous with the corresponding external iliac plexus, internally with its fellow on the middle of the sacrum, and superiorly with the lumbar lymphatic plexus.

2748. *Epigastric Lymphatics.* Arising from the anterior wall of the abdomen, in the vicinity of the umbilicus, they pass from within outwards through the abdominal aponeurosis, and dive into the recti muscles, where they are joined by new twigs which come from these muscles themselves and from the obliqui and transversus muscles. They then unite into several trunks, descend along the course of the epigastric vessels, and subdivide in some small ganglia situated near the crural arch, to terminate afterwards in the external iliac plexus.

2749. *Circumflex Iliac Lymphatics.* Their radicles are distributed in the integuments of the sides of the belly, and pass successively through the substance of the transversus and obliqui muscles, where they are augmented by some others. They then collect into some trunks which descend forwards towards the iliac crest, which they follow, accompanying the circumflex iliac vessels as far as one of the external iliac ganglia.

2750. *Lumbar Lymphatics.* Their roots, which are extremely numerous, commence in the quadratus lumborum, and obliqui and transversus abdominis muscles, and in the interior of the vertebral canal. The trunks which result from their union accompany the lumbar arteries, pass between the quadratus lumborum and psoas muscles, divide into several ganglia placed between the transverse processes, and arrive before the vertebral column, where their numerous anastomoses, united with those of almost all the other trunks which we have hitherto examined, constitute the *Lumbar Lymphatic Plexus.*

7. OF THE LYMPHATIC VESSELS OF THE STOMACH AND INTESTINES.

1751. *Lymphatics of the Intestines.* These vessels are commonly called *Lacteals* or *Chyliferous vessels*, on account of their conveying the chyle from the intestines to the thoracic duct. The name however is inappropriate, as they are intimately mingled with other lymphatic vessels, whose roots are distributed in the substance of the coats of the intestines, while most of theirs open at the inner surface of the same tubes. Both also follow the same course, only that the deep ones *(the Lacteal Vessels properly so called)* are transversely extended upon the intestine, while the superficial run in the direction of its length and parallel to its axis. After anastomosing and crossing each other a great many times, they gain the mesenteric and mesocolic ganglia, divide and subdivide to infinity, at their level, and at length arrive at the commencement of the thoracic duct.

It is observed that the number of lacteal vessels is much greater in the course of the small intestine than any where else. Along the cœcum, ascending colon and arch of the colon, they are already in much smaller number. The descending colon and rectum present only a few common lymphatics which go to the lumbar and hypogastric ganglia, or to those of the mesorectum.

2752. *Lymphatic Vessels of the Stomach.* They are disposed in two planes, a *superficial*, situated beneath the peritoneum, and a *deep plane*, spread out between the muscular and mucous coat. They may also be referred to three distinct orders.

Some of them, arising upon the large extremity of the stomach, descend to the left along the vasa brevia (2429), and join the lymphatics of the spleen.

Others, *(Stomo-gastriques*, Chauss.) direct themselves along the small curvature of the stomach, and divide in the ganglia which occur there. They then collect on the right side of the cardia to bend upon themselves to the right, pass through some other ganglia, and unite with the inferior lymphatics of the liver, under the lobulus Spigelii. After this, they descend along with them behind the pancreas, and attain the roots of the thoracic duct.

Those of the third order descend from the two surfaces of the stomach towards the ganglia placed along its great curvature, and unite into a few trunks towards the pylorus, pass between it and the pancreas, proceed for some time upon the anterior surface of that organ, then turn round it and descend behind it to divide in the ganglia which surround the cæliac and superior mesenteric arteries.

2753. *Lymphatic Vessels of the Great Omentum.* They are not numerous, and ascend to unite with the preceding in the ganglia of the great curvature of the stomach.

8. LYMPHATIC VESSELS OF THE SPLEEN, PANCREAS, AND LIVER.

2754. *Lymphatics of the Spleen.* They are formed of a great number of superficial and deep branches, more numerous on the convex surface of the organ, and all uniting together, near its fissure, into a few trunks which form a plexus around the splenic vessels, divide in some ganglia, enter beneath the duodenal extremity of the pancreas, and unite with the inferior lymphatics of the liver.

2755. *Lymphatics of the Pancreas.* They arise in the substance of that gland, follow the pancreatic blood-vessels, and unite with the lymphatics of the spleen and stomach.

2756. *Lymphatics of the Liver.* They are extremely numerous, nor does any organ in the body appear to contain so many. They also seem generally to a certain extent destitute of valves in their interior, or at least these valves are much looser than any where else. They are distinguished into *superficial* and *deep.*

2757. *Superficial Lymphatics of the Upper Surface of the Liver.* On the right lobe they are naturally collected into four bundles.

The first is formed by those which arise between the laminæ of the suspensory ligament, which, uniting into two or three trunks, enter into the thorax, between the diaphragm and ensiform cartilage, pass through one or two of the ganglia of the mediastinum, again subdivide, receive some lymphatics from the mediastinum and pericardium, pass into some other ganglia, ascend to near the internal jugular vein, and open into the thoracic duct near its termination.

The second arises by a great number of roots, near the circumference of the same lobe to the right side, passes between the laminæ of the right lateral ligament of the liver, and divides into two sets of vessels. The *superior* pass through the diaphragm, place themselves between it and the pleura, proceed to the left, forming a pretty complicated plexus, and enter into the abdomen, along with the aorta, to terminate in the ganglia lodged between that artery and the vena cava inferior. The *inferior vessels* pass between the attachments of the diaphragm and the last ribs, and glide along the latter as far as their articulation with the vertebræ, where they unite with the intercostal lymphatics, to traverse some ganglia, and terminate in the thoracic duct.

The third, of which the roots are scattered upon the middle of the right lobe, gains the posterior part of the liver, and unites in part with the preceding. Some of the trunks of which it is composed ascend in the thorax, between the œsophagus and aorta, and open directly into the thoracic duct.

The fourth comes from the anterior region of the right lobe. Some of its vessels ascend in the suspensory ligament to unite with those of the first bundle. The rest descend in the fissure of the liver, there join the deep vessels, and divide in some ganglia near the pylorus. Several are seen following a retrograde course along the free edge of the liver, and terminating to the right with those of the second bundle.

On the left lobe of the liver, the superficial lymphatics may be distinguished into three separate parcels.

Those of the first parcel ascend from their commencement in the suspensory ligament, and there join those of the first bundle of the right lobe.

Those of the second parcel arise from the whole surface of the left lobe, gain the left lateral ligament of the liver, and there divide into two portions. The *inferior* bend to the right and between the lobule of the liver and the small curvature of the stomach, and lose themselves in some ganglia, where they meet those of the stomach and lower surface of the liver. The *superior* proceed to the left, under the diaphragm, and join the lymphatics of the spleen, near the large extremity of the stomach.

Lastly, the lymphatics of the third parcel come from the posterior part of the left lobe, descend towards the cardia, and go to the ganglia of the small curvature of the stomach.

2758. *Superficial Lymphatics of the Inferior Surface of the Liver.* Some of them take their origin between the circumference of the liver and gall-bladder. They are pretty numerous, descend to the left, and divide in the ganglia which surround the vena cava and aorta. Others originate over the whole surface of the gall-bladder, unite into large trunks, which embrace the neck of that reservoir, and terminate in the ganglia placed behind the duodenum. Some of them issue from the lobulus quadratus, forming a single trunk, which directs itself towards the gall-bladder, and joins the others. Lastly, others still come from the whole extent of the left lobe and lobulus Spigelii, and unite with the preceding, or with the deep lymphatics.

2759. *Deep Lymphatics of the Liver.* They originate in all parts of the parenchyma of the liver, accompanying the ramifications of the blood vessels and biliary ducts, emerge along with them by the fissure, collect in great numbers around the lobule, slip between the laminæ of the hepato-gastric omentum, gain the ganglia of the small curvature of the stomach or those which surround the cœliac artery, and thus terminate towards the commencement of the thoracic duct.

B. OF THE THORACIC DUCT.

2760. This canal, in which terminate all the lymphatic vessels which we have hitherto examined, as well as many others, commences upon the body of the third lumbar vertebra, by the successive union of five or six very large trunks, themselves resulting from the assemblage of all the absorbent plexus of the abdomen.

At the union of all these trunks, near the aortic aperture of the diaphragm, the thoracic duct almost always presents a remarkable dilatation, which is called *Receptaculum (Chyli, Reservoir of Pecquet*, or *Cisterna Chyli)*, and which is placed behind the aorta, at the anterior and left part of the second lumbar vertebra.

Above this enlargement the thoracic duct ascends into the chest, entering between the pillars of the diaphragm, with the aorta on its left side and the vena azygos to the right. It contracts as far as the sixth dorsal vertebra, after which it inclines to the left, becomes sensibly dilated, and ascends behind the arch of the aorta to the left subclavian artery, on the inner side of which it is placed on the longus colli muscle. It then arrives at the seventh cervical vertebra, bends inwards and downwards, passes behind the thyroid artery and the left internal jugular vein, and opens quite close to the latter, into the posterior part of the subclavian vein of the same side. Its aperture is furnished internally of the vein, with two valves which prevent the blood from passing from the vein into the duct.

Sometimes the thoracic duct is straight in its whole extent, but it is more frequently flexuous. In many subjects it divides into several branches, which afterwards unite, forming a kind of islands between them. It frequently separates into two or three trunks at its termination. I once saw it divide into two branches, one of which followed the ordinary course, while the other went to discharge itself into the right subclavian vein, close to the great lymphatic vein of the same side.

OF THE LYMPHATIC VESSELS WHICH THE THORACIC DUCT RECEIVES IN ITS COURSE.

2761. Several lymphatics of the liver and ganglia surrounding the cœliac artery ascend into the thorax by the aortic aperture of the diaphragm, and empty themselves into the thoracic duct at a greater or less height.

2762. *Intercostal Lymphatics.* They arise in the external muscles of the thorax and intercostales, and at first pass through some ganglia lodged between the two planes of the latter. On the sides of the vertebral column, they unite with other vessels which come from the spinal canal and muscles of the back, spread out in the neighbouring ganglia, and then form some plexus before the vertebral column. From thence they descend, to open very obliquely into the thoracic duct. Those of the right side are a little longer than the left.

2763. The thoracic duct moreover receives a multitude of twigs which unite with the preceding, and come from the pleuræ, diaphragm, posterior mediastinum, &c.

C. OF THE LYMPHATIC VESSELS WHICH TERMINATE PARTLY IN THE THORACIC DUCT, PARTLY IN PARTICULAR TRUNKS OPENING INTO THE VEINS.

1. LYMPHATIC VESSELS OF THE LUNGS.

2764. *Superficial Lymphatics.* Placed beneath the pleura, they form on the surface of the lung a series of areolæ of various forms, more commonly hexagonal, and unite into a certain number of trunks which enter the ganglia with which the bronchus is surrounded at its entrance into the organ. These vessels are remarkable for the extreme thinness of their walls.

2765. *Deep Lymphatics of the Lungs.* Disseminated through the whole tissue of the lungs, they follow the divisions of the veins, communicating by a great number of twigs with the superficial lymphatics, with which they at length entirely unite in the bronchial ganglia, whence both emerge to ascend upon the bronchi as far as the trachea. There they meet with new ganglia, divide in them, and more particularly in one of them which occupies the angle formed by the bifurcation of the trachea.

From this large ganglion there issue several trunks, some of which, after ascending upon the trachea and traversing some small ganglia, unite and open into the right great lymphatic vein, while the others, which are much more numerous, traverse ganglia situated in like manner upon the trachea, under the thyroid gland, and collect into two trunks which bend obliquely to the left, behind the internal jugular vein, to discharge themselves into the thoracic duct, or separately into the corresponding internal jugular or subclavian vein.

2. SUBSTERNAL, DIAPHRAGMATIC, CARDIAC, THYMIC, AND ŒSOPHAGEAL LYMPHATIC VESSELS.

2766. *Substernal Lymphatics.* They accompany the internal mammary vessels, embracing them on all sides. They arise from the upper half of the anterior wall of the abdomen, and their roots anastomose with those of the epigastric lymphatics. They enter the thorax between the xiphoid appendage and the diaphragm, ascend behind the sides of the sternum, traverse several ganglia, form some plexus, and unite into trunks of greater or less size. One of these trunks only directs itself to the left side, crosses anteriorly the subclavian vein, throws itself into the inferior jugular ganglia, and terminates in the thoracic duct. The rest open separately on the right side into the subclavian and internal jugular veins.

2767. *Lymphatics of the Diaphragm.* Confounded in a great measure with the intercostal and hepatic lymphatics, they give rise to several principal trunks which proceed forwards, above the pleuræ, upon the convex surface of the diaphragm, unite and divide several times in succession, pass through the inferior ganglia of the mediastinum, and at length join the preceding behind the sternum.

2768. *Lymphatics of the Thymus and Pericardium.* The former are much more numerous and larger in the child than in the adult. Both are confounded with the substernal and pulmonary lymphatics.

2769. *Lymphatics of the Heart.* They have their roots distributed over the whole surface of the heart, and especially towards its summit. They follow pretty accurately the course of the coronary vessels, and ultimately unite into two principal trunks. One of these trunks accompanies the right cardiac artery, ascends upon the anterior side of the aorta, inclines to the left, and terminates in the upper part of the thoracic duct. The other, which is larger, and frequently formed by the alternate anastomoses and divisions of three or four large branches, glides obliquely between the aorta and pulmonary artery, traverses some small ganglia, and gains the thoracic duct or the internal jugular and subclavian veins. Near its termination, it frequently divides into three or four distinct branches.

Some lymphatic vessels of the heart unite separately with those of the lungs.

2770. *Lymphatics of the Œsophagus.* They form a kind of plexus around that canal, anastomose with those of the heart and lungs, and enter the predorsal ganglia.

3. SUPERFICIAL LYMPHATICS OF THE SUPERIOR EXTREMITIES.

2771. Their first roots surround the fingers, at the posterior surface of which they are especially very numerous. Collected into bundles on the sides of each of them, they gain the metacarpus, on which they remain isolated, or anastomose to give rise to some trunks, which direct themselves particularly over the posterior surface of the fore-arm, along which they are enlarged by the addition of a great number of twigs coming from that part of the extremity. They then turn a little inwards, and near the elbow-joint, place themselves upon the anterior surface of the fore-arm. There, they unite with several other trunks which come from the anterior surface of the fingers and palm of the hand, and which accompany the subcutaneous veins. In this manner they arrive at the bend of the arm, and there sometimes meet with one or two small ganglia.

They then ascend along the fore and inner part of the arm, are joined by some trunks which arise from the surface of that region, collect, anastomose, become larger and less numerous, and dive into the axilla, where they terminate in the axillary and subclavian ganglia.

2772. Some vessels of this order separately follow the course of the cephalic vein, pass between the deltoides and pectoralis major muscles, divide into some ganglia, under the clavicle, form a small plexus there, and unite with the inferior cervical lymphatics.

4. DEEP LYMPHATIC VESSELS OF THE SUPERIOR EXTREMITIES.

2773. They are collected into bundles around the arteries which are distributed to these parts, and have precisely the same disposition as these vessels. These lymphatics also terminate in the axillary ganglia.

5. LYMPHATIC VESSELS OF THE ANTERIOR WALL OF THE THORAX.

2774. They commence under the integuments of the abdomen and thorax, around the mammæ, &c. direct themselves outwards and upwards, collect into trunks, gradually increasing in size, in consequence of their anastomoses and the addition of new roots, pass before the pectoralis major, plunge into the cellular tissue of the axilla, and terminate in the ganglia of that part.

2775. Some of these vessels come more deeply from the substance of the pectoralis major, pectoralis minor, and serratus magnus muscles. They have the same termination.

6. LYMPHATIC VESSELS OF THE POSTERIOR REGION OF THE NECK.

2776. *Lymphatics of the Neck.* They commence under the skin, towards the occiput, and upon the spinous processes of the neck, whence they descend outwards following the direction of the fibres of the trapezius, to pass obliquely over the spine of the scapula, and over the deltoides muscle, and unite with the anterior thoracic and dorsal lymphatics in the axillary ganglia.

2777. *Lymphatics of the Back.* The superior, which arise from the integuments and trapezius muscle, descend outwards upon the infraspinatus muscle, where they meet with some ganglia, then enter between the latissimus dorsi and teres major muscles, and terminate, like the preceding, in the axilla. The inferior have their roots distributed over the whole surface of the latissimus dorsi; they ascend obliquely towards the tendon of that muscle, and join the superior.

7. LYMPHATIC VESSELS WHICH ARISE FROM THE AXILLARY GANGLIA.

2778. The axilla contains a very remarkable lymphatic plexus, formed by a great number of ganglia (2686) and by the vessels which terminate in them, connect them with each other, or issue from them. The latter, as they leave the highest and deepest ganglia, are reduced to the number of three or four large trunks which proceed around the subclavian vein, as far as its entrance into the thorax. There, those of the left side collect into one or two trunks which pass between the subclavius muscle and the first rib, and open partly into the corresponding subclavian vein, and partly into the thoracic duct. Those of the right side generally furnish a single trunk, of a large size, which might be compared to the thoracic duct itself, but of inconsiderable length. This trunk, which opens at the angle formed by the union of the right internal jugular and sub-clavian veins, is named the *Right Great Lymphatic vein.* (*Tronc brachio-cephalique*, Chauss.)

8. OF THE SUPERFICIAL LYMPHATIC VESSELS OF THE HEAD AND OF THE ANTERIOR SURFACE OF THE NECK.

2779. *Epicranial Lymphatics.* They are distributed on all sides beneath the skin of the cranium, and may be distinguished into three orders of bundles. The *occipital bundles* unite in ganglia placed behind the mastoid processes, and go to join the superficial lymphatics of the posterior surface of the neck. The *temporal bundles* accompany the veins of that name, gain the parotid ganglia, and mingle with the anterior superficial lymphatics of the neck. The *frontal bundles* collect at the inner angle of the eyes, augmented by the vessels of the eyelids and orbit, and join the lymphatics of the face.

2780. *Lymphatics of the Face.* These arise from all parts of the face, by radicles distributed under the skin. They follow the course of the facial vein, and divide in the submaxillary ganglia, where they are confounded with the following.

2781. *Superficial Anterior Lymphatics of the Neck.* These seem to be a continuation of those of the head, form a plexus which accompanies the subcutaneous veins of the neck, and open by two or three trunks, to the left into the highest part of the thoracic duct, and to the right into the great lymphatic vein of that side.

9. DEEP LYMPHATIC VESSELS OF THE HEAD AND NECK.

2782. *Lymphatics of the Brain.* The lymphatic vessels of the brain and its membranes are not yet known in a satisfactory manner. Although the most minute researches have been made in those parts, there have only been distinctly traced a few trunks that are met with in the dura mater.

2783. *Deep Lymphatics of the Tongue, Palate, Nose, Orbits, Pharynx, Muscles of the Face, &c.* They all follow the course of the blood-vessels, gain the subparotid ganglia and those which envelope the internal jugular veins. They then divide a great number of times, join some trunks coming from the larynx and thyroid body, and open partly into the right and left internal jugular and subclavian veins, partly into the thoracic duct to the left, and into the great lymphatic vein to the right, by a greater or less number of trunks.

CLASS SECOND.

ARTICLE FIFTH.

ORGANS OF THE SECRETIONS.

I.—*ORGANS OF THE SECRETION AND EXCRETION OF THE TEARS.*

2784. These organs, by their continuity, constitute a double organ, placed symmetrically on either side of the median line of the body, and extending from the outer and upper region of each orbit, to the inferior meatus of the nasal fossæ. These two apparatus are pretty frequently designated by the collective name of *Viæ lachrymales.* Each of them consists of the lachrymal gland, the puncta lachrymalia, lachrymal ducts, lachrymal sac, and nasal canal.

1. OF THE LACHRYMAL GLAND.

2785. The *Lachrymal Gland (Glandula Lachrymalis)* is lodged in a depression of the frontal bone, at the upper, outer, and fore part of the orbit. Its size is generally about that of a small almond, but its form is liable to vary. Most commonly it represents an ovoid flattened from above downwards, and from without inwards, and whose greatest diameter is directed from before backwards. Its colour is light yellow inclining to red.

2786. Convex externally and above, the lachrymal gland corresponds in this direction to the periosteum of the orbit, and is connected with it by a multitude of small filaments which proceed from the one to the other. Slightly concave at its inner and under parts, it rests upon the ball of the eye and its external rectus muscle, from which it is separated by a thick layer of adipose tissue. Anteriorly, it is protected by the rim of the orbit, and a little by the upper eyelid. Posteriorly, it is immersed in the adipose cellular tissue of the orbit.

2787. The lachrymal gland is composed of a considerable number of small lobules connected by cellular tissue, and separated from each other by vessels and nerves which creep in their intervals. These lobules themselves are formed of rounded granulations, of a reddish white colour, in which the last ramifications of arteries terminate, and in which the radicles of veins commence, but whose more intimate structure is still entirely unknown. It is presumed that from each of them issues a small excretory canal, which by uniting with others in its vicinity, gives rise to trunks which are somewhat more distinct, although still extremely slender and very little apparent in man. However, according to the testimony of several eminent anatomists, who have seen them injected, it appears that they are six or seven in number, and that they open, internally of the upper eyelid, at some distance from the outer part of the corresponding fibro-cartilage. Their orifices, which are separated by pretty narrow intervals, are seen, it is said, upon the conjunctiva, where their series forms a curved line, the convexity of which is directed upwards and outwards.

2788. A fibro-cellular capsule of considerable thickness envelopes the lachrymal gland, and sends partitions into its substance, which separate the lobules from each other. Moreover, the lachrymal artery (2259), the vein (2597), and the nerve of the same name, must be considered as contributing to the composition of this gland, the use of which is to secrete the tears and pour them upon the fore part of the ball of the eye by the small ducts which we have just mentioned.

2. OF THE CARUNCULA LACHRYMALIS.

2789. The *Caruncula Lachrymalis* is a small reddish tubercle, of a pyramidal form, varying as to size in different subjects, situated in the inner angle of the eyelids, at the fore part of the ball of the eye, behind and within the puncta lachrymalis. Its base is directed backwards and inwards, its summit forwards and outwards (1844).

The caruncula lachrymalis is nothing else than a mass of small mucous crypts whose number is very uncertain, and which are invested by the conjunctiva, which forms anteriorly and externally of them a semilunar fold known by the name of *Membrana nyctitans*, and much more apparent in certain classes of animals than in man. Each of the orifices of these small crypts is furnished with hairs of excessive delicacy, and visible only with a lens.

The caruncula lachrymalis receives some filaments of the nasal nerve, and some vascular ramifications. Its use appears to be to retain the tears in the inner angle of the eye, and furnish a peculiar sebaceous fluid.

2. OF THE PUNCTA LACHRYMALIA AND LACHRYMAL DUCTS.

2790. The *Puncta lachrymalia* are two in number, one for each eyelid. They are very small apertures, more or less apparent in different individuals, commonly of a blackish colour, and occupying the centre of a small tubercle, slightly inclined backwards, and situated at the distance of about a line and a half from the internal commissure of the eyelids, at the place where their edge changes its direction.

These orifices are always open. A small mucous rim, of a white tint, margins their circumference. They are placed opposite each other, but that of the lower eyelid is directed upwards, outwards and backwards, and that of the upper downwards, and also outwards and backwards, so that when the eyelids are closed, they only touch each other on the side next the skin.

2791. The puncta lachrymalia are the external orifices of the lachrymal ducts which carry the tears into the lachrymal sac, through the eyelids, and whose diameter is a little longer than the circumference of the puncta lachrymalia themselves, which makes these canals appear slightly contracted at their origin. The lachrymal ducts are distinguished into superior and inferior, according to the eyelid to which they belong.

2792. The *Superior lachrymal duct*, which is a little longer than the inferior, ascends at first vertically for the space of about a line, then bends nearly at a right angle, and proceeds inwards and downwards along the inner part of the free edge of the eyelid, immediately beneath the conjunctiva. The *inferior lachrymal duct* also at first descends nearly vertically, then directs itself in wards in the same manner, ascending a little to place itself beside the superior. Both in fact, opposite the commissure of the eyelids, proceed alongside of each other, without uniting, and separated by a very thin partition, behind the tendon of the orbicularis palpebrarum, as far as the lachrymal sac, into the middle part of the outer side of which they open separately. In some cases, although rarely, they are seen to unite before entering the sac.

2793. The lachrymal ducts seem to be formed merely of a very delicate prolongation of the conjunctiva, which is thus continuous with the mucous membrane of the lachrymal sac.

4. OF THE LACHRYMAL SAC.

2794. The *Lachrymal Sac (Saccus Lachrymalis)* is a small membranous bag, lodged at the inner angle of the orbit, in the channel formed by the lachrymal bone and the ascending process of the upper maxillary bone. It presents the form of an ovoid situated vertically and a little compressed from without inwards. Its *outer side* is covered anteriorly by the skin, the orbicularis palpebrarum, and its tendon, which divides it transversely into two portions, of which the lower is narrower and more elongated than the upper. Posteriorly, it corresponds to the caruncula lachrymalis and the conjunctiva, and furnishes some insertions to the inferior oblique muscle of the eye. Its *inner side* fills the lachrymal groove (338), and is closely attached to the bones which constitute it. Its *upper extremity*, which is dilated and rounded, forms a more or less remarkable prominence above the tendon of the orbicularis palpebrarum. The *inferior extremity* is continuous with the nasal canal.

2795. *In its interior*, the lachrymal sac is lined by a mucous membrane, which is continuous with the mucous membranes of the eye and nasal fossæ. This membrane adheres strongly to the bony groove. Its colour is reddish. The existence of crypts or follicles cannot be discovered in it, although it is very soft and as it were pulpy. It is always covered with mucus.

2795. *At the exterior*, the lachrymal sac is formed by a fibrous aponeurotic membrane, which many anatomists have considered as the *reflected tendon* of the orbicularis palpebrarum. This membrane, which is white, dense and strong, is fixed on all sides to the bony edge of the lachrymal groove. Anteriorly, it is intimately united to the tendon of the orbicularis palpebrarum and to some of its fleshy fibres, to which it even gives insertion. It may also, in a certain degree, be considered as a prolongation of it.

2797. The arterial ramifications of the lachrymal sac are especially derived from the palpebral arteries. Its nervous filaments come from the external nasal nerve.

5. OF THE NASAL DUCT.

2798. We have already described this canal with relation to the bones of which it is composed (350). It is sufficient for us here to say that the bony canal is lined by a cylindrical prolongation of the mucous membrane of the lachrymal sac, which forms in its interior another canal, which is rather thin, and has no valve in its course. This second canal adheres feebly to the periosteum, and opens, by a very contracted orifice, under the inferior turbinated bone. This orifice, although free, is furnished with a circular fold formed by the pituitary membrane.

2799. The nasal canal transmits into the nose the tears which the puncta lachrymalia have absorbed at the inner angle of the eye.

II.—*OF THE ORGANS OF SECRETION AND EXCRETION OF THE SALIVA, OR OF THE SALIVARY GLANDS AND THEIR DUCTS.*

GENERAL OBSERVATIONS.

2800. The *Salivary Glands* are symmetrically placed, to the number of three on each side of the face, behind and beneath the lower jaw. Their form is in general very irregular, and their extent varies much in the different subjects in which they are examined. Sometimes they are perfectly distinct and isolated; at other times, they seem to be confounded with each other. But they all present characters which are common to them, and which serve to distinguish them from the other glands of the body.

Thus their vessels penetrate them on all sides, and are already much ramified before arriving in their parenchyma; while the liver, the spleen, and the kidneys receive theirs by a determinate point, and under the form of more or less voluminous trunks.

They are supplied with a considerable number of nervous filaments from the encephalic system; while the liver has but a very small number, and the kidneys none at all.

Their colour is grayish, their tissue firm and strong; the granulations of which they consist are successively united into lobules and irregular lobes, which gives them the greatest resemblance to the pancreas and lachrymal gland.

They are enveloped by no particular membrane, as is the case with the liver, the kidneys, &c. They merely seem surrounded by a thin layer of cellular tissue, destitute of fat, and very different from the fibrous membranes.

Lastly, their excretory ducts all open in the interior of the mouth, without any intermediate reservoir, while the tears, the bile, the urine, the seminal fluid, &c. are contained for some time in a reservoir before arriving at their destination.

Of the Salivary Glands in Particular.

1. OF THE PAROTID GLAND.[*]

The *Parotid Gland* is the largest of the salivary glands. It is situated partly before and partly beneath the external ear, filling up the deep excavation which exists on the sides of the face, between the posterior edge of the ramus of the lower jaw, the meatus auditorius externus, and the mastoid process of the temporal bone. It extends vertically from the zygomatic arch to the angle of the jaw. Its form is that of a very irregular pyramid, with an oval base directed outwards.

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[*] Παρα, *juxta*; οὖς, ὠτός, *auris.*

2802. Its *outer surface*, which is broad, flat, oval, slightly convex, and having no precise limits, extends more or less upon the face. It is covered by some fibres of the platysma myoides and by the skin, under which creep some nervous filaments. Its circumference is prolonged anteriorly over the masseter muscle, and superiorly over the articulation of the jaw. At the under part of this circumference, from which Steno's duct takes its rise, the branches of the facial nerve are seen emerging.

2803. The *anterior surface* corresponds above to the articulation of the lower jaw, externally to the posterior edge of the same bone, and internally to the pterygoideus internus muscle. It is moulded upon these different parts, and penetrates into their intervals.

2804. Its posterior surface is connected by pretty dense cellular tissue with the meatus auditorius externus, the mastoid process, the anterior edge of the sterno-cleido-mastoideus, the posterior belly of the digastric muscle, the styloid process, and the muscles which arise from it. It is coasted internally by the internal carotid artery, and by the internal jugular vein. The external carotid artery, at the moment of its termination, and especially the superficial temporal artery, are also in connection with this surface of the parotid gland. They are even generally enveloped by its parenchyma, especially the latter, which traverses it from below upwards; while the facial nerve, which is also placed in the gland during part of its course, passes transversely through it.

2805. The parotid gland furnishes, by each of the granulations of which it is composed, a very slender excretory duct, which unites with those in its vicinity, in the manner of veins, to form somewhat larger twigs, then branches, and lastly a considerable trunk named the *Parotid Duct* or *Steno's Duct*. This duct emerges from the fore and outer part of the gland, a little above the middle of the height of the masseter muscle, over which it proceeds horizontally, from behind forwards, to turn over its anterior edge, and sink into the adipose cellular tissue of the cheek. Having arrived upon the buccinator muscle, it passes through an aperture formed in the midst of its fibres, and terminates in the mouth, opposite the second molar tooth of the upper jaw, at the distance of about three lines from the meeting of the cheek with the corresponding gums.

The parotid duct does not pass through the buccinator obliquely, but perforates it perpendicularly, and forms an angle as it passes through the mucous membrane of the mouth, proceeding a little forwards. Its orifice is besides very contracted, and furnished with a small fold of the mucous membrane, so that it is not easily perceived.

It very frequently receives, about the middle of its length, another duct which proceeds from a glandular body placed in its vicinity, and which appears to be an accessory gland to the parotid. This body is in fact placed before the masseter muscles, either above or beneath the duct, sometimes even in its course. Its surface is commonly smoother than that of the gland itself.

Steno's duct is but loosely connected with the neighbouring parts. It is accompanied by several branches of the facial nerve, and by some arteries which furnish ramifications to its walls. Placed immediately under the skin, it is only separated from it internally by some fibres of the platysma myoides, and by the zygomaticus major, which crosses its direction obliquely.

It is about a line in diameter, but its cavity is very narrow. Its walls are composed of two distinct membranous layers. The *outer* is firm, strong and thick, of a whitish colour, and fibro-cartilaginous appearance. It acquires still greater density towards the end of the duct, which without increasing in capacity, becomes conical. Near the buccinator muscle it gives rise superficially to a thin aponeurosis which covers its fleshy fibres, while it also gives attachment to some of the fibres of that muscle as it passes into the aperture of which we have spoken above, and by which these fibres are actually interrupted and not merely separated. The other membranous layer of the duct is *internal*. It is essentially mucous, and very delicate, and appears to be continuous with the membrane which lines the cheeks, differing from it only in whiteness.

2806. There are always found, in the substance of the parotid gland, a great number of branches of the facial nerve, the transverse artery of the face, the posterior auricular artery, and the vein which forms a communication between the internal and external jugular vein. It thus receives the greater part of its vessels and nerves; but a branch of the inferior maxillary nerve and one of the ascending branches of the cervical plexus furnish it with a few additional nerves. Its lymphatic vessels are pretty numerous, and pass into the ganglia situated at its surface or behind the angle of the jaw. Its parenchyma differs in nothing from that of the other salivary glands.

2. OF THE SUB-MAXILLARY GLAND.

2807. This gland is smaller than the parotid, and is situated at the inner edge of the ramus and body of the inferior maxillary bone, in the triangular space which the two bellies of the digastric muscle leave between them. Irregularly ovoidal and flattened on these surfaces, frequently bifurcated at its fore part, it is prolonged externally as far as the angle of the jaw, and is sometimes confounded in this direction with the parotid gland. *Internally*, the superficial portion of its anterior extremity advances towards the digastric muscle, and the deep portion, which is engaged behind the mylo-hyoideus muscle, touches the sublingual gland. In the same direction, it is separated from its fellow by the anterior bellies of the digastric muscles and the genio-hyoidei. *Anteriorly*, it is covered by the inferior maxillary bone, and *posteriorly*, is in connection with the lingual nerve, the stylo-glossus and hyo-glossus muscles, and the facial artery, which it embraces. *Inferiorly*, it rests upon the platysma myoides and the integuments. *Superiorly*, it is prolonged more or less between the pterygoideus internus and mylo-hyoideus. It is moreover surrounded by a pretty considerable, although variable number of lymphatic ganglia.

2808. The excretory duct of the sub-maxillary gland is commonly designated by the name of *Wharton's Duct*. It is much smaller than Steno's duct, and has much thinner walls, which are transparent, and more elastic. Arising in the same manner by very slender radicles in the lobules of the gland, it issues from its deepest portion, passes between the mylo-hyoideus and hyo-glossus muscles, and proceeds nearly horizontally from without inwards, and a little forwards, between the genio-glossus and the sub-lingual gland, from which it often receives several excretory ducts. When it has arrived upon the side of the frenum linguæ, it places itself beneath the mucous membrane of the mouth, and terminates in this place by a very narrow orifice, situated in the middle of a slightly prominent tubercle. It is coasted, in its whole extent, by the lingual nerve, and lined in its interior by a prolongation of the mucous membrane of the mouth. Perhaps it is entirely formed by the latter.

2809. The arteries of the sub-maxillary gland are numerous, but of small size. They are furnished by the trunk of the facial and the branches of the lingual arteries. Its veins correspond exactly to the arteries. Its nerves come from the lingual nerve (1596), the myloid branch of the inferior dentar nerve (1598), and the sub-maxillary ganglion (1893).

The cellular envelope of the submaxillary gland is proportionally much thinner than that of the parotid gland. The structure of the two organs is precisely similar.

OF THE SUBLINGUAL GLAND.

2810. The *Sublingual Gland* is placed in the substance of the inferior wall of the mouth, under the fore part of the tongue, and seems in general to be merely a sort of appendage to the submaxillary gland. Its position is nearly horizontal, and its direction parallel to that of the opposite side. It is smaller than the submaxillary gland, of an oblong form with its greatest diameter from behind forwards, transversely flattened, and nearly of the shape of an almond. It rests upon the mylo-hyoideus muscle, which separates it from the preceding gland, and is covered by the mucous membrane of the mouth, beneath which it forms a prominence. It is moreover in connection, *internally*, with the genio-glossus muscle; *anteriorly*, with the body of the jaw; *posteriorly*, with the deepest extremity of the submaxillary gland, with which it often appears confounded between the hyo-glossus and mylo-hyoideus muscles.

2811. This gland has several excretory ducts, whose disposition is liable to much variation. They are always very slender. Six or eight proceed from its upper part to open upon the sides of the frenum linguæ, while five or six others issue from its lateral parts, and perforate singly the mucous membrane of the floor of the mouth. Two, three, or even a greater number, are also seen to end in the sub-maxillary duct. These latter are very short, and frequently unite into a single trunk before terminating. All these ducts appear to have the same structure as that of the sub-maxillary gland, and like it are thin and transparent.

2812. The arteries of the sublingual glands come from the facial and sublingual; their nerves are furnished by the lingual and hypoglossal.

OF THE PANCREAS OR SECRETING ORGAN OF THE PANCREATIC FLUID.

2813. The *Pancreas** is a gland which is deeply seated in the abdomen, lying across the vertebral column, between the three curvatures of the duodenum, behind the stomach, and to the right of the spleen. Its form is irregular and very variable, as are also its extent and weight, the latter being from two to six ounces.

This organ, which is much longer than broad, and flattened from before backwards, is slightly concave posteriorly, to be accommodated to the curvature of the vertebral column. Its right extremity is larger than the left.

2814. Its *anterior surface*, which is inclined upwards, is covered by the upper lamina of the transverse mesocolon, the stomach, and the first portion of the duodenum.

2815. Its *posterior surface* presents at its upper part a groove in which are lodged the splenic vessels. It corresponds, moreover, to the superior mesenteric vessels, the aorta, the vena cava, and several nervous and lymphatic plexus.

2816. Its *upper edge* is intersected by the course of the cœliac artery, and is directed backwards. The *lower edge* lies upon the third portion of the duodenum, and is separated from it by the superior mesenteric vessels.

2817. Its *left extremity*, which is very thin, is prolonged beneath the spleen, to near the corresponding supra-renal capsule, and is often named the *Tail of the Pancreas*. The *right extremity*, which is also frequently named the *Head*, is thicker, broader, irregularly rounded, immersed in a mass of adipose tissue, and applied against the second portion of the duodenum, over which it commonly advances a little. There almost always occurs beneath it a small detached glandular mass, which is named the *Small Pancreas*.

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* Πᾶν, *omne*; κρέας, *caro*; all fleshy.

2818. The pancreas bears the greatest resemblance to the salivary glands in its structure. It is of a grayish white colour, inclining a little to red; and its parenchyma, which is firm and tenacious, appears composed of lobes and granular lobules, which are distinct and connected by a dense cellular tissue. It is from each of these granulations and lobules that the radicles of its excretory duct arise, which are very slender, and unite in the manner of veins.

The duct itself is almost always single. Sometimes however there are two or even three. Placed in the substance of the organ, a little nearer its lower than its upper edge, directed from left to right, and progressively increasing in size from the numerous branches which it receives in its course, this canal proceeds in a serpentine manner towards the duodenum, disengages itself from the granulations of the gland, becomes free behind the second portion of the above-mentioned intestine, and is then of the size of a crow-quill. Near its extremity it receives an excretory duct which comes singly from the little pancreas, and, after a very short passage, it opens at an acute angle, into the ductus communis choledochus, or merely adheres to it to enter the duodenum by itself. The walls of this duct are whitish, and thicker than those of the submaxillary ducts, but they are far from being so dense as those of the parotid ducts.

2819. Besides resembling the salivary glands in its tissue, it bears an affinity to these organs in several other points. Like them, it is placed in the midst of parts of great mobility. It has no distinct outer envelope, being in fact only covered in an indirect manner, and in a portion of its extent only, by the peritoneum, which does not adhere to it, as happens in the case of the liver, the spleen, &c. Like them also, it is penetrated on all sides by a multitude of vascular ramifications; but there is no artery which peculiarly belongs to itself. There is this remarkable difference between them however, that while the salivary ducts have a pretty long course after leaving the glands, the pancreatic duct is free and isolated only for a very short space.

2820. The arteries of the pancreas are very numerous, but their size is very small. They come from the cœliac, splenic, upper mesenteric, right gastro-epiploic, coronary, and left capsular arteries. Its veins pour their contents into the roots of the vena portæ, and in particular into the small mesaraïc and splenic veins. Its nerves are supplied by the solar plexus; and its lymphatics go to be divided in ganglions to which it gives its name (2709).

2821. The pancreas secretes a fluid which appears to have much resemblance to the saliva, and which mingles with the bile to be poured into the duodenum.

III.—*OF THE ORGANS OF THE SECRETION AND EXCRETION OF THE BILE.*

Of the Liver.

GENERAL CONFORMATION.

2822. The *Liver** is the largest of all the glands. It is a single, unsymmetrical organ, very dense, of great weight, easily torn, and of a reddish brown colour. It occupies the whole right hypochondrium, and a part of the epigastric region. Its general form is irregular, but approaches to that of the section of an ovoid made in the direction of its length. Its absolute weight, in the adult, varies, according to Soemmering's experiments, from two to five pounds, and its specific weight is 15,203. Limited above by the diaphragm, it is protected anteriorly by the base of the thorax, beyond which it does not pass in the sound state, although it may be liable to undergo some slight changes of position, according to the state of the neighbouring organs, and the posture of the body.

2823. *Upper Surface of the Liver.* It is convex in its whole extent, more so however to the right side and posteriorly than elsewhere. It is turned directly upwards at the left extremity; in the middle, it looks backwards; and to the right, is inclined straight outwards. It is everywhere contiguous with the diaphragm, which it even seems to push upwards, rendering it more concave on the right side than on the left. A fold of the peritoneum, which we shall describe as we proceed, and which is commonly called the *Suspensory Ligament of the Liver*, divides it from before backwards into two unequal portions, which are named the *Great* or *Right Lobe*, and the *Middle* or *Left Lobe*.

2824. *Inferior Surface of the Liver.* This surface is of less extent than the upper, very irregularly concave, and inclined a little backwards. It presents from left to right the following parts:

1. A broad and superficial depression, which belongs to the middle lobe, and rests upon the upper surface of the stomach.

2. The *Groove of the Umbilical Vein* (the *Horizontal* or *Longitudinal Groove* of Boyer), passing from before backwards, and separating the two lobes below, as the suspensory ligament does above. This groove is more or less deep, and in its lower half is pretty frequently converted into a true canal by a portion of the substance of the liver, which passes from one lobe to the other. In the fetus,

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* Ἧπαρ of the Greeks, *Jecur* of the Latins.

it lodges anteriorly the umbilical vein, and posteriorly the venous sinus; and in the adult it is occupied by the fibrous cords which are formed by the remains of these obliterated vessels.

3. The *Groove of the Vena Portæ*, or *Transverse Groove*. This is a fissure less deep and shorter than the preceding, which it intersects at right angles, and which follows the direction of the great diameter of the liver. It occupies about the middle third of that organ, a little nearer its posterior than its anterior edge. It commences upon the right lobe by a sort of narrow slit, then enlarges much as it proceeds towards the left side, but never presents the appearance of a canal. It lodges the sinus of the vena portæ (2689), the hepatic artery (2449), the roots of the hepatic duct, and a great number of nervous filaments and lymphatic vessels. All these parts are connected together by a kind of dense, compact, and fibrous sheath.

4. The *Groove of the Vena Cava Inferior*. It is situated behind, near the convex edge of the liver. It is very short, but remarkably deep, and is often converted into a true canal (2668).

5. The *Posterior Portal Eminence, Small Lobe of the Liver*, or *Lobulus Spigelii*. This is a kind of mammillary eminence of very great size, which is placed behind the transverse groove of the liver, in the back part of the cavity of the peritoneum, beneath the gastro-hepatic omentum. Its form, which is subject to considerable variation, is more commonly that of a more or less obtuse triangular pyramid. Two prolongations appear to fasten its base to the great lobe of the liver. One of these gradually loses itself at its surface; the other ascends posteriorly towards the groove of the vena cava inferior, which it even contributes to form. This eminence rests posteriorly upon the vertebral column, between the vena cava inferior and the œsophagus, and looks as if squeezed between the two orifices of the stomach, the pancreas, and the rest of the liver.

6. The *Anterior Portal Eminence*. It is of less size than the posterior, broad, and little elevated. It separates the anterior half of the groove of the umbilical vein from a superficial fossa of an oval form, which lodges the gall-bladder.

7. Two superficial depressions, of which the anterior corresponds to the right extremity of the arch of the colon, while the posterior corresponds to the right kidney and the renal capsule of the same side.

2825. *Circumference of the Liver*. It is irregularly quadrilateral, varying in thickness at the different parts of its extent, and is everywhere, excepting at its lowest part, embraced by the peritoneum.

Anteriorly, it is thin, convex, applied against the base of the thorax, and always interrupted by two notches. Of these, one is narrow and deep, and is formed by the anterior extremity of the groove of the umbilical vein; the other is broader, but more superficial, and placed to the right of the first; it corresponds to the fundus of the gall-bladder. This part of the circumference of the liver is horizontal in the middle, but to the right and left is inclined downwards.

Posteriorly, the circumference of the liver is shorter than before; but its thickness is considerable, especially to the right. It is rounded, and attached to the diaphragm, near its extremities, by two folds of the peritoneum, which are named the *Lateral* or *Triangular Ligaments* of the liver. At the middle, it is united to the diaphragmatic aponeurosis, in an intimate manner, by a dense and close cellular tissue. It also presents the end of the groove of the umbilical vein, and that of the vena cava, together with the trunks of the hepatic veins.

To the right, the circumference of the liver is thin at its fore part, thick behind. It is in contact with the diaphragm. *To the left*, it presents a thin and convex edge, which is sometimes prolonged as far as the spleen under the form of a pretty broad tongue.

B. ORGANIZATION OF THE LIVER.

2826. The structure of the liver is extremely complicated, and presents successively for examination envelopes, blood-vessels, lymphatics, nerves, a peculiar parenchyma, and an excretory apparatus.

a. ENVELOPES OF THE LIVER.

2827. *Serous or Peritoneal Envelope.* This a prolongation of the peritoneum, reflected from the lower surface of the diaphragm over the liver, which it does not surround in its whole extent. This envelope is transparent, smooth, polished, thin, and constantly bedewed with a serous fluid. Free on the side next the abdominal cavity, it adheres by its other surface to the second envelope, and does not cover the posterior part of the circumference of the organ, the two grooves of its inferior surface, that of the vena cava, and of the fossa destined to lodge the gall-bladder. It is equally wanting in the interval of the two laminæ of the suspensory ligament, as it is of itself that this alleged ligament is formed.

2828. *Cellular* or *Deep Envelope.* It is much more extended than the superficial, for it covers all the parts of the liver upon which the peritoneum is not applied, and is prolonged into the substance of that viscus, forming sheaths which accompany the branches and twigs of the vena portæ and hepatic artery, as well as the roots of the hepatic duct. These sheaths commonly bear the name of *Capsule* of *Glisson.* They adhere to the parenchyma of the liver by numerous filaments, and do not present the least appearance of the muscular structure which Glisson attributed to them. In general very thin, although pretty dense, this envelope is much more apparent in the places of the surface of the liver where it exists alone, than in those where it is in connection with the peritoneum, to which it adheres in a pretty intimate manner.

b. BLOOD-VESSELS AND LYMPHATICS OF THE LIVER.

2829. They are very numerous. Some of them carry the blood to the liver: such are the hepatic artery (2449), the vena portæ (2688), and, in the fetus, the umbilical vein. Others carry it off, after it has resided for some time in the organ: these are the hepatic veins (2677). We have already described all these vessels.

The lymphatics of the liver have also been described (2756, 2759). They are extremely numerous.

Its nerves are also very abundant. They come from the pneumo-gastric nerve (1640), the diaphragmatic nerve (1665) and the hepatic plexus (1846).

c. PARENCHYMA OF THE LIVER.

2830. Considered with respect to its interior, the substance of the liver presents a reddish or yellowish tint superadded to the brown colour of its surface. Its general aspect is porous, from the great number of small vessels which have been divided in cutting it. There are moreover observed in it small yellow dots irregularly disseminated, which correspond to the radicles of the excretory ducts of the bile. Another remarkable fact is, that the nature of the vessels which traverse the parenchyma of the liver in different directions, is indicated by the direction which they follow. Thus the branches of the vena portæ and hepatic artery, and the roots of the hepatic duct, proceed horizontally in the direction of the great diameter of the liver, while the trunks of the hepatic veins direct themselves in a converging manner towards its posterior edge. Further, the orifices of the divided branches of the vena portæ are collapsed, and those of the hepatic veins remain circular. This depends upon the circumstance, that the former of these vessels is accompanied by a cellular sheath which prevents it from adhering to the parenchyma of the liver, while the others being destitute of that particular envelope, are intimately united to it.

2831. If the tissue of the liver be torn in place of being cut, it then appears uneven and formed of an immense quantity of roundish grains or solid polygons, in which end the extreme ramifications of the vena portæ and hepatic artery, and whence proceed the radicles of the biliary ducts, hepatic veins, and deep seated lymphatics. These granulations are about the size of a millet seed, of a soft consistence and dark red colour, and appear to be united to each other by cellular tissue, which does not form them into lobules as in the salivary glands and the pancreas. The most minute researches have disclosed nothing further with respect to their intimate structure. Some anatomists, Ruysch in particular, have supposed them to be formed by the interlacing of the different vessels of the liver, others, as Malpighi, have made utricles or a kind of vesicles of them; but nothing can be more unsatisfactory than these hypotheses to those who do not entirely abandon themselves to their imagination.

2. *Excretory Apparatus of the Bile.*

2832. This apparatus consists of the hepatic duct, which immediately issues from the liver, and after passing over a certain space, unites with the cystic duct, which ends in the gall-bladder, and of the ductus communis choledochus, which results from this junction, and terminates in the duodenum.

HEPATIC DUCT.

2833. It takes its origin by a great number of very slender radicles in the granulations of the liver. These radicles successively unite into larger branches which accompany divisions of the vena portæ and hepatic artery, and which are, like them, enveloped by the capsule of Glisson. These branches are then united into two principal trunks, one for the left lobe, the other for the right, which issue by the transverse groove of the inferior surface of the liver, converge towards each other, closely connected with the corresponding branches of the vena portæ, and end at a right angle. At the very point of union, some small branches of indeterminate number and variable size join them.

In this manner is formed the hepatic duct, which is about an inch and a half in length and about a line and a half in diameter, and descends obliquely inwards between the laminæ of the gastro-hepatic omentum, and in the midst of a considerable quantity of adipose cellular tissue, before the vena portæ, behind the right branch of the hepatic artery, to the left of the neck of the gall-bladder and cystic duct.

GALL-BLADDER.

2834. The *Gall-Bladder*, *(Cystis fellea)*, is a membranous, pyriform or ovoidal reservoir, situated in a superficial depression of the under surface of the right lobe of the liver. It is placed obliquely, so that its large extremity is directed forwards, to the right and downwards, while its summit looks backwards, upwards, and to the left. When the body is upright, or when it lies upon the right side, this inclination is more marked than in any other position. It diminishes, on the contrary, when the stomach and intestines are filled with alimentary substances or gases.

In the gall-bladder there are distinguished a body, a fundus, and a summit or neck.

The *body* adheres above over a variable extent to the substance of the liver, through the intervention of a layer of lamellar cellular tissue, and through several ramifications of blood vessels, but no biliary ducts are observed to pass from the one to the other of these organs, as the older anatomists supposed, when they created the *hepato-cystic ducts.* Inferiorly, the body of the gall-bladder is free and covered by the peritoneum, which gives it a smooth and polished appearance. It lies in this direction upon the pylorus, the commencement of the duodenum, and the right extremity of the arch of the colon.

The *bottom* is rounded, more or less broad in different subjects, and covered in whole or in part by the peritoneum. In general it passes beyond the circumference of the liver, and corresponds to the walls of the abdomen, and to the outer side of the corresponding rectus muscle.

The *neck* or *summit* is a little curved upwards, and very narrow. It is continued into the cystic duct.

2835. The internal surface of the gall-bladder is almost always tinged with green from the effect of the bile which it contains in its cavity. It is rough, reticulated, and plicate, presenting in its whole extent rounded or polygonal areolæ of very variable breadth and depth, and more especially apparent towards its middle.

In the vicinity of the neck of the gall-bladder, there are observed several small valvular and prominent folds, to the number of three, four, six or seven, which appear destined to diminish the velocity of the bile in its passage. This is what M. Amussat presented to the Royal Academy of Medicine of Paris, on the 25th March 1824, as a spiral valve, a sort of Archimedes's screw.

2836. The gall-bladder has walls composed of three superimposed membranes, a serous, a cellular, and a mucous.

2837. *Serous Membrane.* This membrane belongs only to the free surface of the gall-bladder, and is formed by the peritoneum which is reflected from the lower surface of the liver, and which is continuous with the superior lamina of the gastro-hepatic omentum.

2838. *Cellular Membrane.* It is pretty compact. It is chiefly in its substance that the blood-vessels and lymphatics creep. On the side next the liver, it is it that produces the adhesion of the gall-bladder; on the other surface, it unites the serous with the mucous membrane. It sometimes contains a little fat in such of its cellules as are near the neck.

2839. *Mucous Membrane.* Its thickness is pretty considerable. During life it is whitish, and it is only after death that it is tinged green by the transudation of the bile. Neither crypts nor follicles are perceived in it, there being only found in it some small grains analogous to these organs between the valvular folds of the neck.

It is, however, covered with a great number of fungoid papillæ very close to each other.

2840. No traces of fleshy fibres are discovered in the walls of the gall-bladder. Its arteries are furnished by the cystic twig of the hepatic artery. Its veins go to the vena portæ. Its nerves come from the hepatic plexus, and its lymphatics join those of the liver.

CYSTIC DUCT.[*]

2841. Placed, like the hepatic duct, in the substance of the gastro-hepatic omentum, it is a little smaller than it, but has nearly the same length. Directed inwards, backwards, and a little upwards, it meets it under an acute angle, runs along it for some time, and at length unites with it. Its left side is in connection with the trunk of the cystic artery, and behind it is the orifice of the posterior cavity of the omenta.

DUCTUS COMMUNIS CHOLEDOCHUS.[†]

2842. The *Ductus communis choledochus* results from the union of the cystic and hepatic ducts; but it appears to be the continuation of the latter. From three to three and a half inches long, and equally lodged between the laminæ of the gastro-hepatic omentum, before the vena portæ and above the hepatic artery, surrounded with cellular tissue, ganglions and lymphatic vessels, it descends behind the right extremity of the pancreas, and the second portion of the duodenum, inosculates with the pancreatic duct, or merely runs along side of it, enters obliquely between the fleshy and mucous coats of the intestine, and opens, an inch lower, in the duodenum, near its last curve. Its mouth is placed upon a small mammillary eminence, and is furnished with a membranous fold.

2843. The different excretory ducts of the bile are formed by two distinct membranous laminæ, an inner and an outer. The *outer* appears composed of white and longitudinal fibres; the *inner*, is mucous, very thin, and furnished with a small number of papillæ. It is continuous with the internal membranes of the gall-bladder and duodenum.

3. *Of the Spleen.*[‡]

GENERAL CONFORMATION.

2844. The *Spleen (Lien)* whose uses, although entirely un-

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[*] Κύστις, vesica. [†] Χολὴ, bilis, δεχομαι, accipio, recipio. [‡] Σπλὴν.

known, seem to have some connection with the secretion of the bile, is a parenchymatous, vascular viscus, of a soft and spongy texture, and of a dark red colour, inclining to black, rarely uniform, and almost always marbled. It is placed deeply in the left hypochondrium, beneath the diaphragm, above the descending colon, between the tuberosity of the stomach and the cartilages of the false ribs, before the corresponding supra-renal capsule and the upper part of the kidney of the same side. It is attached to the surrounding organs in a more or less loose manner by folds of the peritoneum, and by a great number of vessels. Its form is that of a segment of an ellipse, of which the greatest diameter is nearly vertical. Its volume presents the most numerous variations, and cannot be given with precision, any more than its weight. Its specific gravity, however, is to that of water as 1160 to 1000.

2845. Most commonly the spleen is single. Sometimes however it is accompanied by some small bodies of the same nature, which are of variable form, and are lodged in the omentum.

2846. The *Outer Surface* of the spleen is convex and in contact with the diaphragm. It corresponds to the ninth, tenth, and eleventh ribs of the left side. The *inner* is divided into two parts by a longitudinal groove called the *Fissure of the Spleen*. This fissure never occupies the whole length of the organ, and is filled by vessels and a certain quantity of fat. The posterior portion of the inner surface of the spleen is applied upon the left side of the vertebral column ; the anterior, which is a little larger, corresponds to the great cul-de-sac of the stomach.

2847. The *circumference* of the spleen has a very irregular form. Thicker above and behind than below and before, it is smooth and rounded, but intersected from space to space by notches varying in depth and number. It corresponds above to the aponeurosis of the diaphragm, below to the left kidney and supra-renal capsule, behind to the pancreas, before to the walls of the thorax, through the intervention of the diaphragm.

ORGANIZATION OF THE SPLEEN.

2848. *Serous Envelope.* It is formed by the peritoneum, and invests the whole exterior of the spleen, with the sole exception of the bottom of the fissure, on the edges of which it is reflected to be continued into the laminæ of the membranous folds which fix the spleen to the stomach and diaphragm. Thin, transparent, smooth at its outer surface, and adhering by the other, it is applied upon another envelope of a fibrous nature.

2849. *Fibrous Envelope.* It adheres intimately to the preceding by its outer surface, and by its inner it sends a great number of delicate prolongations into the parenchyma of the organ. At the bottom of the fissure, it is in contact with adipose cellular tissue, and furnishes other more distinct prolongations which accompany the vessels in the interior of the spleen, and whose number is consequently indeterminate. It is of a grayish white colour, pretty thick, strong, elastic, scantily supplied with vessels, and destitute of nerves.

2850. *Blood-vessels.* No organ has more blood-vessels, in proportion to its size than the spleen. Its principal artery, which is furnished by the cœliac trunk, is remarkable for its size, the thickness of its walls, its numerous windings, and the manner in which it divides in the fissure. But it receives, moreover, some branches which come from the capsular, diaphragmatic, first lumbar and spermatic arteries of the left side. Its veins are not larger than the arteries, and are especially remarkable for the thinness and extensibility of their walls. They have no internal valves, and form one of the principal roots of the vena portæ.

2851. *Nerves.* They separate from the solar plexus under the name of splenic plexus (1858), and are furnished by the solar ganglia and by the left pneumo-gastric nerve.

2852. *Lymphatic Vessels.* The lymphatics of the spleen we have already described (2754).

2853. *Cellular Tissue.* There occurs a rather thin layer around the splenic arteries and veins, and it may be followed pretty deeply into the substance of the liver, but not between the secondary divisions of the vessels, the interstices of which are filled with serum.

2854. *Granulations.* I give this name to a certain number of soft, grayish, semi-transparent, and as it were gelatinous corpuscles, of the size of a pin's head and sometimes almost imperceptible, which are disseminated irregularly in the tissue of the spleen. Their nature is entirely unknown. Malpighi considers them as small glands.

2855. *Parenchyma of the Spleen.* It is of very variable consistence, although in general soft and as it were spongy. Its colour is deeper than that of the spleen at its interior. It always contains a very great quantity of blood, which seems to be identified with its tissue, and which is met with in three different states, viz. in the arteries and in the veins, as takes place in other organs, and in a sort of intimate combination with the other organic elements and with a certain quantity of albumen. The latter is thick, slightly viscous, opaque, of a livid red colour like wine lees. It appears to be contained in very numerous cellules or areolæ destined for itself, of which the outer walls are formed by the prolongation of the internal surface of the fibrous envelope of the spleen. Some anatomists think, however, that these cellules have no existence, and that the parenchyma of the spleen is essentially formed of arterial and venous capillary vessels, with very thin and very extensible walls, and communicating immediately with each other.* This much is certain, that the vascularity of all the apparent fibres of the spleen has been recently proved by injection.

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* Marjolin, Manuel d'Anatomie, T. ii. p. 449. Paris, 1815, 8vo.

IV.—*OF THE ORGANS OF SECRETION AND EXCRETION OF THE URINE.*

a. OF THE SUPRA-RENAL CAPSULES.

2856. The *Supra-renal Capsules (Renes succenturiati, vel Capsulæ atrabiliariæ)* are two small bodies placed in the abdomen, without the peritoneum, above the kidneys, of which they embrace the upper extremity. They are never wanting, but their uses are totally unknown. Hollow and oval in the adult, they are prismatic and granulated in the fetus, in which their volume is much greater than in the adult, on which account it has been supposed that they must have some connection with the exercise of nutrition in the first stages of life.

These capsules, which are of a yellowish-brown colour, more or less tinged with red, present a *posterior surface* which corresponds to the diaphragm and the upper part of the psoas muscle; an *anterior surface* covered on the right side by the vena cava inferior, the duodenum and the liver, and on the left side by the spleen and pancreas; and an *inferior surface*, which is concave, and applied upon the summit of the corresponding kidney.

2857. The left supra-renal capsule is commonly a little higher than the right, a difference which depends upon the position of the two kidneys. Both are kept in position by a great quantity of adipose cellular tissue, by some denser filaments which are prolonged as far as the kidneys, and by the vessels which they receive or which emerge from their tissue.

2858. Each supra-renal capsule is only, properly speaking, a small bag with thick parenchymatous walls, formed of very small granulations, collected into lobules, and having but little consistence, especially at the exterior. In its interior there exists a narrow, transverse, smooth, triangular cavity, without any known orifice, furnished in its inferior part with an eminence in the form of a ridge, and containing in the fetus a considerable quantity of a reddish, viscous fluid, coagulable by alcohol. In children, this fluid is yellowish; in old people brown, and in very small quantity.

2859. The supra-renal capsules receive a great number of arteries which arise from the aorta, the inferior diaphragmatic and renal arteries, and which are larger in the child than in the adult. The veins of those of the right side pour their blood into the vena cava; those of the left side open into the renal vein. Their lymphatics enter into the formation of the emulgent and inferior diaphragmatic plexus. Their nerves come from the renal plexus (1851).

b. OF THE KIDNEYS.*

1. GENERAL CONFORMATION.

2860. The *Kidneys (Renes),* the secreting organs of the urine, are two glands deeply situated in the lumbar regions, on the sides of the vertebral column, opposite the last two dorsal and the two first lumbar vertebræ, behind the peritoneum, one to the right, the other to the left. Their number sometimes varies. Thus individuals have been seen to present three kidneys, and others a single kidney lying transversely upon the vertebral column.

The kidneys are enveloped on all sides by a very solid and very thick mass of fat, in which they seem imbedded. It is also commonly observed that the left kidney is higher than the right, on account of the difference in size between the liver and spleen.

The colour of the kidneys is a dark red, inclining to brown. Their form is that of an ovoid compressed on two surfaces, and notched on its inner edge, like a kidney-bean. Their volume is proportionally larger in children than in adults, in women than in men.

2861. The *anterior surface* of the kidneys is very convex and sometimes completely covered by the peritoneum. At other times it is more or less in connection, to the right side, with the vertical portion of the duodenum, the liver and the ascending colon, and to the left, with the spleen and the descending colon.

2862. Their *posterior surface,* which is almost flat, is applied upon a thick layer of fat which separates it from the diaphragm and the aponeurosis of the transversus abdominis muscle.

2863. Their *circumference* presents: 1st superiorly, a thick and rounded extremity, embraced by the corresponding renal capsule: 2dly, inferiorly, a thin and somewhat elongated extremity, which approaches more or less the iliac spine; 3dly, externally, a thick convex edge, inclined backwards; 4thly, internally, a deep notch, more distinct anteriorly than posteriorly, and called the *Fissure of the Kidney.*

2. ORGANIZATION OF THE KIDNEYS.

2864. Each kidney receives from the aorta an artery of considerable diameter, although rather short (2483), and sends to the vena cava inferior corresponding veins (2680). A very distinct nervous plexus accompanies these vessels (1851), and around them there also occur lymphatic vessels (2749). We have already described all these organs, so that there only remains for us to examine the proper parenchyma of the kidney and its envelope.

2865. The parenchyma of the kidney is firmer than that of the other glands. It appears composed of two distinct substances, an external or *cortical*, and an internal, named *tubular* or *mammillary*.

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* Νεφροι of the Greeks.

2866. The cortical substance of the kidneys forms around these organs an external layer, one or two lines thick, of a dark or reddish bay colour, and adhering to their capsular membrane. Internally, it furnishes several prolongations in the form of septa, between which are placed the conical bundles of the tubular substance, and which diminish in thickness towards the pelvis, from which they are separated by fat. This substance tears with great ease. under the microscope, it appears composed of solid granulations of a very small size, formed by the capillary extremities of the renal arteries and veins.

2867. The *tubular substance* represents a number of conical, truncated bundles, of unequal size, enveloped on all sides, excepting towards their summits, by the cortical substance. The base of all these cones is rounded and directed towards the circumference of the kidney; their summit, on the contrary, is directed towards the pelvis or fissure of the kidney.

The colour of this substance is pale red, especially at the centre of each of the cones. Its tissue is dense, firm and tenacious. It is formed of a great number of delicate convergent canals, very close upon each other towards the summit of the cones, and directly continuous with the vessels of the cortical substance, from which they derive their origin. They are as it were expanded at the surface of each cone, while towards its summit they open at the interior of the infundibula by orifices extremely close upon each other. The summits of the cones represent so many mammillæ at the surface of which the urine thus oozes out.

Some anatomists have made of the mammillæ a third substance, which they have designated by the name of the *mammillary substance*; but their structure is absolutely the same as that of the cones which they terminate. They differ only in being a little paler in their colour. Their number, which is generally equal to that of the cones, varies from twelve to eighteen; but, in some subjects, two cones are seen ending in a single mammilla, or two mammillæ terminating a single cone. They are separated from each other by a considerable quantity of adipose cellular tissue. They are often short and blunt, but they are also seen to prolong themselves into a more or less distinct prominence of a cylindrical or pointed form. The orifices of the canals of the tubular substance which are perceived at their surface are much less numerous than the canals themselves, on which account it is to be presumed that several of the latter unite before terminating.

2860. *Membranous Envelope of the Kidneys.* It covers the whole surface of these organs, and dips into their fissure, where it is traversed by the divisions of the renal vessels, and is reflected upon the free surface of the pelvis. It may be detached with much more ease from the cortical substance, with which it is connected by filaments, which although numerous are yet very delicate, and by some very small ramifications of blood-vessels. It is rather thin, transparent, and possessed of little extensibility, and appears to be of a fibrous nature.

2869. The urine secreted in the cortical substance of the kidneys passes through the ducts of the tubular substances, and thus arrives in the infundibula, the pelvis, and ureter, which we now proceed to examine.

C. OF THE CALYCES, PELVIS, AND URETER.

2870. The *Calyces (Infundibula)* are small membranous ducts which embrace, on the one hand, the circumference of the mammillæ, and on the other, open deeply in the pelvis, and only at its extremities or towards the side of it which faces the convexity of the kidney. Their number varies from six to twelve, one of them frequently belongs to several mammillæ at once. Their diameter is always proportional to the number of mammillæ which they embrace, and they are surrounded by much fat.

2871. The *Pelvis* is a small membranous bag which occupies the posterior part of the fissure of the kidney. It is placed behind the renal artery and vein. It is elongated from above downwards, flattened from before backwards, presenting an irregularly oval form, much contracted below to be continued into the ureter. The orifices of the infundibula are perceived in its deepest part.

2872. The *Ureter* is a long membranous canal, of a cylindrical form, and about the size of a writing quill, extended obliquely between the pelvis, with which it is continuous, and the bottom of the bladder, into which it opens. It commences in the sinuosity of the kidney by a hollowed portion, which is named the *Infundibulum.* From thence it descends obliquely inwards as far as the sacro-iliac symphysis, being then only separated from its fellow by the breadth of the base of the sacrum. It then continues to descend in the same direction, directing itself a little forwards, in the midst of much fat, to the inferior posterior wall of the bladder, between the muscular and mucous membrane of which it passes, contracting a little. It proceeds thus between them for the space of about an inch, directing itself inwards and forwards, and, on arriving at the posterior angles of the trigonal space of the bladder, terminates there by a narrow oblique orifice, which is destitute of any kind of valve, as is the *infundibulum.*

In this course, the ureter corresponds from above downwards, and *posteriorly*, to the psoas magnus muscle, the common iliac vessels, whose direction it crosses, and the hypogastric vessels. *Anteriorly*, it is at first covered by the peritoneum and the spermatic artery; then, in the excavation of the pelvis, it is crossed in the male by the vas deferens. It is, moreover, to be observed, that the ureter of the right side is placed externally of the vena cava inferior, to which it is parallel.

2873. The calyces, pelvis, and ureter appear to have the same organization. Their walls are composed of two membranes.

The *outer* of these membranes is thick, of an opaque white colour, covered externally of the pelvis and ureter by a prolongation of the fibrous capsule of the kidney.

The *inner* is mucous, very thin, white, and semitransparent. It is prolonged from the calyces over the mammillæ, and, perhaps, even introduces itself into the uriniferous tubes.

D. *OF THE BLADDER.*

1. GENERAL CONFORMATION.

2874. The *Bladder (Vesica urinaria)* is a musculo-membranous reservoir, lodged in the adult in the excavation of the pelvis, immediately behind the pubes, and destined to retain for some time the urine, which is afterwards to be ejected from it. Sometimes, but very rarely, the bladder is entirely wanting, and then the ureter opens into the rectum or vagina. Somewhat more frequently, its anterior wall is wanting, and the posterior forms externally a soft and spongy tumour at the lower part of the abdomen.

The form and dimensions of the bladder vary in a remarkable manner in the different sexes and ages. In the adult male, it is conical; in children it is cylindrical, much elongated from above downwards, and protruding above the upper strait of the pelvis. In the adult female, especially if she has born several children, it is rounded, and is broader than long.

The bladder also presents some variations in its dimensions, which appear to depend upon our mode of living in society, and the contracted habit of retaining the urine for a greater or less time. Its capacity, however, is generally greater in the female than in the male.

The direction of the bladder is never absolutely vertical; but it is slightly inclined from above downwards and from before backwards, and its summit is a little inclined to the left. When, in consequence of the accumulation of the urine, it is distended to such a degree as to rise above the symphysis of the pubes, this obliquity becomes still more obvious.

2. EXTERNAL SURFACE OF THE BLADDER.

2875. This surface, which is unequally convex, is divided into six different regions, distinguished from each other by their relative position.

2876. *Superior Region.* It is also named the *summit of the bladder.* It is seldom entirely invested by the peritoneum, that membrane being only applied upon its posterior half. It is habitually in contact with the inferior circumvolutions of the small intestine. From its centre there is seen rising the *Urachus*, a kind of fibrous cord which ascends between the peritoneum and the linea alba to the umbilicus, where it terminates by becoming confounded with the abdominal aponeurosis. It appears destined solely to fix the bladder. In man it never forms a canal excepting in cases when the urethra is wanting; but in the fœtuses of quadrupeds, it establishes a communication between the bladder and the *Allantois.* On the sides of this region of the bladder, are also seen the two umbilical arteries (2507).

2877. *Inferior Region.* It is limited anteriorly, but only in the male, by the base of the prostate gland, and posteriorly by a fold which the peritoneum forms in passing over the rectum or uterus. Laterally it has no determined limits. This region, which is of greater extent than the superior, has very important relations, which differ in the sexes. Its most retired part is called the *Fundus* or *Bottom of the Bladder.* In the male, it is connected, by a cellular tissue loose behind and dense before, to the vesiculæ seminales and the end of the vasa deferentia. Between the two vesiculæ, it rests upon the rectum, from which it is separated by an immense quantity of vessels and especially veins. Externally of the vesiculæ, it is in remote contact with the levator ani.

In the female, it corresponds solely to the levator ani and the vagina.

2878. *Anterior Region.* It is not covered by the peritoneum. It is of great extent, and corresponds to the posterior surface of the body of the pubes through the intervention of a great thickness of adipose tissue. When the organ is distended by urine, it rests in its upper portion, against the anterior wall of the abdomen. From the lower part of this region, there is seen to arise a small depressed fibrous bundle, which directs itself horizontally behind the symphysis of the pubes, into which it is inserted, and which is named the *Anterior Ligament of the Bladder.* It is immediately applied upon the prostate gland.

2879. *Posterior Region.* Smooth and entirely invested by the peritoneum, it is limited inferiorly by the folds which that membrane forms as it passes over the rectum in the male, and the uterus in the female, and which are improperly called the *Posterior Ligaments of the Bladder.* It is contiguous, in the male, to the rectum, and in the female, to the uterus. Pretty frequently, there glide between it and these two organs, one or more convolutions of the small intestine.

2880. *Lateral Regions.* They are narrower above, where they are in relation with the peritoneum, than below, where they are coasted by the umbilical arteries and the vasa deferentia, and where they are immersed in the adipose cellular tissue of the pelvis.

2881. The *Neck of the Bladder*, viewed externally, represents, in the male, a kind of truncated cone, longer laterally and inferiorly than above. It is nearly horizontal in the adult, and is directed obliquely forwards and downwards in the child. It is embraced anteriorly by the prostate gland, and rests posteriorly upon the rectum.

3. INTERNAL SURFACE OF THE BLADDER.

2882. The internal surface of the bladder is formed by a mucous membrane furnished with a great number of villosities, much less apparent than those of the stomach or intestines. It presents, in the greater part of its extent, and in its empty state, numerous irregular rugæ which disappear when the bladder is full. In certain subjects only, there are observed elongated persistent prominences, crossing each other in different directions, and separated by cellules varying in breadth and depth. This disposition is owing to a greater development of the muscular fasciculi of the bladder; and when it exists, the bladder which presents it, is commonly called a *Columnar Bladder. (Vessie à colonnes.)*

2883. The name of *Trigonal Space of the Bladder (La trigone de la vessie*, Lieutaud,) is given to a smooth triangular surface, on the inside of the bladder, in the middle of its fundus, and where the mucous membrane is destitute of rugæ. The two posterior angles of this triangle correspond to the mouth of the ureters, and the anterior to the origin of the urethra. Its sides are each about an inch long. Its base is directed backwards, and its summit forwards. The walls of the bladder are a little thicker here than elsewhere.

2884. The orifice of the urethra, which is also named the *Neck of the Bladder*, has the form of a kind of crescent, of which the circumference is pretty thick. It embraces a small tubercle which is designated by the name of the *Uvula Vesicæ (Luette vésicale)* and which is formed by the projection of the mucous membrane.

2885. The *Fundus* or *Bottom of the Bladder* is in general all that part of its internal surface that corresponds to the inferior region of its external surface (2877).

4. ORGANIZATION OF THE BLADDER.

2886. *Peritoneal* or *Serous Coat.* Placed entirely at the surface, it belongs to the peritoneum, which from the upper edge of the pubes, is reflected over the superior, posterior, and lateral regions of the bladder, the only parts of that organ which are connected with it. A rather loose cellular tissue unites it to the muscular coat, and is then prolonged all round the bladder, of whose walls it seems to constitute a distinct layer.

2887. *Muscular Coat.* It is intermediate in colour and thickness between those of the stomach (2058) and œsophagus (4041). It is pretty thick towards the fundus, between the vesiculæ seminales, and at the superior region, but is everywhere else extremely thin. It is composed of a great quantity of small whitish fasciculi, flattened, and affecting various directions. The greater number however are longitudinal, a few only being transverse. Those which are situated in the median line appear to ascend from the prostate gland and the neck of the bladder towards the urachus. The rest arise from the lateral parts of the neck, and cross each other at the superior region. Sometimes, as we have already said (2882), they unite into cylindrical columns, which cross each other, and are more or less prominent.

The neck of the bladder is not surrounded by a particular muscle, as some anatomists aver, who have even designated this alleged muscle by the name of the *Sphincter*. The fleshy fibres are only brought closer together around it than elsewhere; and they are there applied upon a layer of whitish, firm, elastic, extensile tissue, having a fibrous appearance, which is prolonged, becoming thinner as far as the base of the trigonal space, and which contributes to form the prominence of the uvula vesicæ.

2888. *Cellular Coat.* This is a thin layer of pretty dense, extensile, lamellar and filamentous tissue, which connects together in an intimate manner the mucous and muscular coats of the bladder, and in which numerous vessels and nerves are seen to creep.

2889. *Mucous Coat.* Continuous with that which lines the ureters and urethra, this membrane is thin and whitish, especially towards the neck of the bladder. In the rest of its extent, it is frequently marbled with a slight red tint. Its villosities are very delicate and not readily seen. In the natural state, no crypts or mucous follicles have been yet perceived in it; in certain pathological cases, however, their presence is very apparent.

2890. *Vessels and Nerves.* The arteries of the bladder arise from the hypogastric (2485), umbilical (2482), ischiatic (2494), middle hemorrhoidal (2491), and internal pudic arteries (2497). They vary much in number and size. The largest are situated on the lateral parts of the bottom and in the vicinity of the neck. They have all a very flexuous course.

Its veins, which are much more numerous than its arteries, join the hypogastric venous plexus (2640).

Its nerves emanate from the sciatic (1731) and hypogastric (1832) plexus.

Its lymphatic vessels ramify in the hypogastric ganglia (2718).

CLASS THIRD.

ARTICLE FIRST.

ORGANS OF GENERATION IN THE MALE.

2891. The organs of generation in the male are very numerous, and exhibit great differences as to situation, texture, and uses. Some of them, the testicles, secrete the seminal fluid; others, the vesiculæ seminales, hold it: another, the penis, carries it into the organs of the female.

I. *Of the Testicles and their Appendages.*

1. OF THE ENVELOPES OF THE TESTICLES.

2892. These envelopes consist of five layers or coats, the cutaneous envelope, the dartos, the tunica erythroides or cremaster muscle, the fibrous coat, and the tunica vaginalis, which, by their superposition, form a kind of bag, divided into two equal portions by an internal septum,* and which bears the name of *Scrotum.*

Attached above to the pelvis, and free in every other direction, this bag is laterally contiguous to the inner and upper part of the thighs; anteriorly to the penis; and posteriorly is separated from the anus by an interval of the extent of two or three fingers' breadth, to which the name of *Perinæum* is given. It is loose and elongated in weak and old persons, after coition, and during the action of debilitating causes; drawn up and contracted upon the testicles in strong and vigorous men, and during cold weather. Its right side is generally higher than the left: a circumstance which has not escaped the notice of painters and sculptors.

2893. *Cutaneous Envelope of the Testicles.* This is merely a prolongation of the skin of the inner part of the thighs, the perinæum, and penis. It is remarkable for its brown colour, always darker than that of the other parts of the skin, the numerous rugosities which it presents, especially when contracted, the great quantity of sebaceous follicles which it contains in its substance, and the scattered, long, and twisted hairs which arise from it in the adult. These hairs are inserted obliquely, and their bulbs produce distinct eminences at the surface. The scrotum is moreover divided into two lateral portions by a prominent line, named the *Raphe*,* which runs from the anterior margin of the anus to the root of the penis.

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* Οσχεον of the Greeks.

This first envelope of the testicles has the same organization as the skin in general, only its chorion is so thin, that the blood-vessels which creep in the dartos may easily be perceived through it.

2894. *Of the Dartos.* The Dartos are two cellulo-filamentous membranes, traversed by a vast quantity of vessels of all kinds, entirely destitute of fat, of a reddish tint, attached to the rami of the ossa pubis and ischii, whence they descend towards the raphe, to which they closely adhere. Above it they are reflected from beneath upwards, come into mutual contact, forming a septum, and terminate at the lower parts of the urethra, thus separating the two testicles from each other. Their outer surface adheres to the cutaneous envelope of the scrotum in the greater part of its extent. The inner corresponds to the fibrous coat, and adheres to it by some prolongations. It also covers the extremities of the cremaster muscle.

The dartos appear entirely cellular, nor do they exhibit any appearance of muscular fibres, although some authors would have them to be muscles. These membranes are besides considerably strengthened by a thin and flat fibrous band, which proceeds from the upper and outer part of each inguinal ring.

MM. Chaussier and F. Lobstein were of opinion that the dartos do not exist in the scrotum previous to the descent of the testicles, and my friend Dr. Breschet has confirmed the assertion by recent researches.†

2895. *Of the Tunica Erythroides*‡ or *Cremaster Muscle.*§ The Cremaster, which is very thin and often not easily distinguishable, is in a great measure a continuation of the fibres of the obliquus abdominis internus which are attached to the anterior and superior iliac spine (1086). However it also seems to receive some fibres from the transversus muscle, and to be in part attached to the inner surface of Poupart's ligament near the inguinal ring, and to the neighbouring region of the pubes. Arising from these different points, its fasciculi collect towards the ring, form a small mass at the outer side of the sheath of the spermatic cord and pass outwards. They then separate and expand upon the cord, and disappear entirely in the scrotum.

This muscle supports the testicle and impresses upon it slight motions from beneath upwards during the act of copulation.

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* Ραφη, *Sutura.*

† See *Dict. des Sciences Medicales*, T. viii. p. 10.

‡ Ερυθρος, *ruber*; εἶδος, *figura.*

§ Κρεμαστὴρ, *ligamentum suspensorium.*

2896. *Of the Fibrous Coat.* It forms a kind of small elongated bag, placed in each dartos, broad below, to contain the testicle and epididymis, and ascending under the appearance of a narrow sheath, around the spermatic vessels as far as the inguinal ring, between the pillars of which its fibres insinuate themselves. Inferiorly, some of its fibres are also intimately connected with those of the dartos. It is thin, transparent, and possessed of little solidity. The older anatomists confounded it with the serous coat, under the names of *Tunica vaginalis** or *elytroides.*†

2897. *Of the Serous Coat* or *Perididymis.* Like all the serous membranes, it forms a closed sac, reflected upon the organ which it envelopes, without however containing it in its cavity. Supposing it to arise from the lower part of the preceding fibrous bag, we find it covering the whole of its interior, embracing, especially anteriorly, the lower parts of the spermatic cord, reflecting itself over the epididymis and testicle, and entirely covering the latter, excepting at its upper edge. Its *outer surface* is invested anteriorly by the fibrous coat; and, posteriorly, adheres strongly to the epididymis and tunica albuginea. Its *inner surface* is smooth, polished, and bedewed with a serous fluid.

This membrane is almost as thin as the arachnoid. It is by it that the fluid is secreted which constitutes the species of dropsy named *hydrocele.* In very young subjects, before the testicles have descended into the scrotum, it is distinctly continuous with the peritoneum. This circumstance accounts for the formation of *congenital inguinal herniæ,* in which the intestine is in immediate contact with the testicles.

2. OF THE TESTICLES.

a. GENERAL CONFORMATION.

2898. The *Testicles (Testes, Testiculi*‡*)* are two glandular organs, lodged in the scrotum, and destined for the secretion of the semen. Their number appears in general invariable, there being no example recorded of the existence of three or four testicles. It is also probable that, when only one has been met with, the other has been contained in the abdomen. Their size, in the adult is sufficiently known to every person; one of them is frequently larger than the other; the right testicle is also generally a little higher than the left; their form is that of an ovoid laterally compressed; their great diameter is slightly oblique; their consistence and weight are considerable in the adult, and they are much less developed in children and old persons.

2899. The testicles are covered in the greater part of their extent, by the serous membrane of which we have already spoken

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* *Vagina*, a sheath.

† ’Ελυτρον, *vagina, tegumentum.*

‡ Δίδυμοι.

(2897). There may be distinguished in each of them two slightly convex lateral surfaces, a lower edge inclined forwards, an upper edge turned backwards and coasted by the epididymis, an anterior extremity looking upwards, and a posterior directed downwards.

b. ORGANIZATION OF THE TESTICLES.

2900. A fibrous membrane, secreting vessels, blood-vessels, lymphatics, nerves, and cellular tissue enter into the composition of the testicles.

2901. *Fibrous Membrane* or *Tunica Albuginea.* This membrane is of an opaque white, not unlike the sclerotica (1856), although a little thicker. It is distinctly fibrous, close in its tissue, traversed by blood-vessels, strong and very tenacious, and serves as a direct envelope to the testicle, whose form it determines. Its *outer surface* is covered by the serous coat (2897). The *inner*, which is applied upon the proper substance of the testicle, sends into the interior of the latter a great number of filiform or flattened prolongations, which all direct themselves towards its posterior edge, where they terminate. These imperfect septa divide the cavity of the tunica albuginea into several triangular cells, filled by the seminiferous vessels. One of them generally traverses the testicle from one extremity to the other.

2902. Internally of the tunica albuginea, along the upper edge of the testicle, is an oblong prominence, a little broader above than below, and which is commonly named the *Corpus Highmorianum (Sinus des Vaisseaux séminifères*, Chauss.) This body appears to be nothing else than a bulging of the membrane itself, through the upper part of which there pass obliquely the principal trunk of the seminiferous vessels which go to the epididymis. Some anatomists, on the other hand, consider it as a kind of canal into which these vessels open. Others, among whom is Swammerdam, make it an assemblage of arteries and veins.

2903. *Parenchyma of the Testicles.* This parenchyma, which is very soft, presents itself at first sight under the appearance of a kind of yellowish or gray pulp, marbled with reddish, and traversed by the very thin small septa which arise from the inner surface of the tunica albuginea, and which seem to divide that substance into lobes and lobules. But when carefully examined, the parenchyma of the testicle appears to be formed of an immense quantity of very minute and flexuous filaments, interlaced and bent in all directions, and loosely connected with each other. Their strength is considerable, although their tenuity is such that, according to Monro's experiments, they cannot be more than $\frac{1}{200}$ of an inch in diameter. Although they do not ramify, their number is great; the same author estimates it at about sixty-two thousand five hundred, and he thinks that their total length may be valued at five thousand two hundred feet. Capillary arteries and veins of still greater minuteness are observed among them.

These filaments are the *seminiferous vessels* or *ducts*, whose cavity has not yet been demonstrated by injections. What is positively known with respect to them is, that they present at intervals, small bulgings, which some have taken for glandular granulations, and others as mere replications, and that they all direct themselves towards the upper edge of the testicle. Before arriving there, several of them unite together to form larger trunks, into which mercury may be passed from the epididymis.

These trunks, to the number of ten or twelve, sometimes twenty or thirty, traverse the corpus highmorianum opposite and a little below the head of the epididymis, dilate a little, describe some sinuosities, and unite to give rise to the canal which forms the epididymis.

We have no certain knowledge with respect to the intimate structure of these canals, their minuteness rendering their examination impossible.

2904. The arteries of the testicles come from the spermatic. (2451). The spermatic veins take their origin in their substance. (2643). It is not ascertained that any serous filament penetrates their interior; but a great number of lymphatic vessels are seen to issue from them. (2710).

3. OF THE EPIDIDYMIS.

2905. The *Epididymis* * *(Parastata)* is a small oblong, vermiform body, enlarged at its extremities, thin in its middle part, and flattened from beneath upwards. It lies along the upper edge of the testicle, to which it appears superadded.

Surrounded by a great number of vessels from which it receives several ramifications, the epididymis has a pretty distinct grayish tint. Its upper part, or *head*, is much larger than the rest. It embraces the corresponding extremity of the testicle, of which it receives the seminiferous trunks, and presents several modulated prominences upon its surface. Its lower part, or *tail*, adheres pretty firmly to the testicle, and bending upwards and backwards, is continuous with the vas deferens. Its middle part, or *body*, is only in general connected with the testicle by the intervention of the tunica vaginalis, which goes from the one to the other.

The epididymis is situated exteriorly of the sac which that membrane forms, which only covers it in the places where it does not adhere to the testicle, and which itself adheres pretty strongly to its surface. On leaving it to invest the testicle, it forms between the two organs two oblong, triangular sinuosities placed in contact by their summits.

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* Επι, super ; *διδύμος, testiculus.*

2906. The epididymis is nothing but a canal formed by the union of all those which have traversed the corpus highmorianum. This canal or duct, which is very slender and bent upon itself a multitude of times, describes numerous flexuosities which are connected by cellular bridles. Its walls are very thick in proportion to its caliber. Its length is great; Monro makes it amount to thirty-two feet. Its volume increases in proportion as it advances from the head towards the tail of the epididymis.

2907. There is pretty frequently seen to arise from the middle of this organ a small canal which ascends in the middle of the spermatic cord, and whose termination is not well known.

4. OF THE SPERMATIC CORD.

2908. The *Spermatic Cord (Funiculus Spermaticus)*, composed of the spermatic artery and vein, of some other inconsiderable and irregular blood-vessels, of lymphatics, of nervous filaments coming from the spermatic plexus (1825), and from the genito-crural branch of the lumbo-abdominal plexus (1709), and of a duct for the semen called the vas deferens, is enveloped by several membranous layers, and contains a great quantity of cellular tissue in the intervals of its constituent parts.

From the upper edge of the testicle, which is suspended at its extremity to the symphysis pubis, the spermatic cord, commonly shorter on the right side than on the left, and of variable size, ascends almost vertically. There, it receives numerous veins from the scrotum, and then directs itself outwards and upwards to enter into the abdomen by the inguinal ring, crossing the epigastric artery (2514). Then the organs of which it is composed separate from each other, and follow a course with which we are already acquainted.

The membranous layers which surround the spermatic cord are the fibrous coat of the testicle (2896), and its tunica erythroides (2895).

5. OF THE VAS DEFERENS.

2909. The *Vas Deferens* or *Ductus Deferens*, arising from the tail of the epididymis, ascends, describing several flexuosities, behind the testicle, and immediately enters the spermatic cord, behind and internally of the spermatic artery and the nerves which accompany it. After clearing the inguinal ring, it leaves the other vessels of the cord, descends backwards and inwards, parallel to that of the opposite side, upon the sides of the bladder, passes behind the umbilical artery, and before the lower part of the ureter. Then arriving under the inferior and posterior region of the bladder, it approaches its fellow, is flattened in a remarkable manner, becomes more adherent, and changes its direction so as to proceed almost horizontally from behind forwards, and from without inwards, along the inner edge of the vesiculæ seminales. At the base of the prostate gland, it receives a canal coming from the vesiculæ seminales, and is continued into the ejaculatory duct.

2910. The vas deferens, from being rather slender near its origin, and so long as it is contained in the spermatic cord, increases in size on passing through the inguinal ring, and becomes twice as large along the vesiculæ seminales. At its termination, it resumes its original size. With respect to its dimensions, no duct has so small an internal diameter. Its cavity is scarcely capable of admitting a hair from the epididymis to within the abdomen; but near the vesiculæ seminales it sensibly increases. Its walls, which are of a dull white colour, have an almost cartilaginous consistence, and are very thick. Although it is probable, from analogy, that they are lined by a mucous membrane, it has not been actually demonstrated.

II.—*OF THE VESICULÆ SEMINALES, PROSTATE, AND DUCTUS EJACULATORII.*

1. OF THE VESICULÆ SEMINALES.

2911. The *Vesiculæ Seminales* are two small membranous bags which form a reservoir for the semen. Placed under the bladder, before the insertion of the ureters, above the rectum, behind the prostate gland, externally of the vasa deferentia, and internally of the levatores ani muscles, of an irregular conical form, flattened from above downwards, tubercular and bulged in the whole surface, immersed in a mass of adipose cellular tissue, traversed by a great number of arteries and veins, they have no communication with each other, and are directed obliquely from without inwards, and a little from above downwards. Widely separated behind, and only disjoined by the vasa deferentia before, they circumscribe between them a triangular space, in which the bladder is in contact with the rectum (2879). Their *posterior extremity* or *fundus* is a rounded cul-de-sac of considerable breadth; their *anterior extremity* or *neck* is elongated, narrow, and sometimes concealed by the base of the prostate. It terminates by a very short canal which opens into the vas deferens.

2912. The vesiculæ seminales have generally in the adult a length of two inches and a half, a breadth of six or seven lines towards their fundus, and a thickness of two or three lines.

2913. The interior of the vesiculæ seminales seems, at first sight, to form a cavity composed of numerous cellules, separated by partitions; but it in reality represents a flexuous canal, terminating above in a cul-de-sac, and into which there open laterally simple or compound appendages, to the number of six, eight, ten, fifteen, or even twenty. These appendages give rise to the prominences observed at the external surface. They are very close to each other, and connected together by a dense cellular tissue. They may be separated by careful dissection, especially if the parts have been previously macerated.

2914. The vesiculæ seminales are commonly filled with a thick, yellowish, opaque fluid, of a peculiar smell, and of an aspect very different from that of the semen which is ejaculated during life.

2915. The walls of the vesiculæ seminales are evidently formed of two membranes. The *external*, which is rather dense and whitish, appears to have some resemblance to the substance which forms the vas deferens, only it is thinner. The *internal*, which belongs to the order of mucous membranes, is very fine and almost white. It is a little wrinkled, and is similar to that which lines the gall-bladder.

The vesiculæ seminales are entirely destitute of muscular fibres.

2. OF THE PROSTATE GLAND.

2916. The *Prostate Gland (Prostata)* is a body of considerable size, formed by an assemblage of mucous follicles, and surrounding the commencement of the urethra in the male. It has the form of a truncated cone, flattened from above downwards, and superficially notched at its base, which is directed backwards. Its axis is nearly horizontal, but inclined a little forwards and downwards. It is much thicker behind, and on the sides than before.

Its *upper surface* is immediately covered by the inferior ligament of the bladder. The *lower surface* rests upon the rectum, to which it adheres by a pretty dense cellular tissue. It is smooth and plain. Each of its surfaces is traversed longitudinally by a superficial groove. Its *sides* are rounded and correspond to the levatores ani muscles. Its *base* embraces the neck of the bladder, and forms around it a rather remarkable prominence, especially on the sides. Its *summit* terminates upon the membranous portion of the urethra by gradually becoming thinner.

2917. The prostate gland is traversed longitudinally, and nearer its upper than its under surface, by a canal wider in the middle than at its extremities, and which lodges the commencement of the urethra, or surrounds at least the upper three fourths of the circumference of that canal. In its lower part, it is also traversed by the two ejaculatory ducts, which are lodged in a conical canal of which the summit is directed forwards.

2918. The prostate gland is of a grayish white colour. Its tissue, which is very dense and firm, is of a nature very difficult to be well described. It is filled internally with a great number of small follicles containing a viscid, ropy fluid of a whitish colour. From these follicles arise excretory ducts which collect to the number of ten or fifteen, and open into the urethra, on the sides and at the surface of the *verumontanum*. By compressing the prostate gland, the fluid which it contains may be made to distil from the orifices of these ducts.

3. OF COWPER'S GLANDS.

2919. *Cowper's Glands*, named also *Accessory Glands*, are two small granulated, oblong or rounded, glandular bodies, placed parallel to each other before the prostate, on the sides of the urethra, and above the bulbo-cavernosi muscles. They are about the size of a pea, of a reddish colour, and of a tissue which is pretty firm and resembling that of the salivary glands. These glands, which are sometimes wanting, have each an excretory duct about six lines in length, which creeps obliquely inwards and forwards in the spongy tissue of the urethra, and opens before the *verumontanum*.

A small gland of the same nature has sometimes been met with in the angle formed by the union of the two roots of the corpus cavernosum.

4. OF THE EJACULATORY DUCTS.

2920. The *Ejaculatory Ducts (Ductus ejaculatorii)* are formed by the junction at an acute angle of the vasa deferentia with those which terminate the vesiculæ seminales. They are of a conical form, and about an inch in length. They proceed forwards, parallel to each other, in the substance of the prostate gland, unite with each other, contracting considerably, and open into the urethra by two small oblong orifices, situated upon the lateral and anterior parts of the verumontanum. Before their termination, they bend a little outwards.

III.—OF THE PENIS.

a. GENERAL CONFORMATION.

2921. The *Penis* or *Membrum virile* is destined to pour into the genital parts of the female the prolific fluid secreted by the testicles. It is a cylindrical, elongated, erectile organ, situated at the anterior, inferior, and middle part of the abdomen, beneath and before the symphysis pubis.

In the ordinary state, the penis is soft and pendent before the scrotum. Its volume then varies much, not only in different individuals, but also in the same person, from a multitude of different causes. During erection, it elongates, assumes a triangular form, and rises more or less upwards.

Its *upper surface* or *back* looks forwards in the ordinary state, and is directed backwards during erection. The course of the dorsal vein is seen at its middle part. Its *lower surface* is turned in the contrary direction to that of the upper. It rests upon the scrotum, and presents a middle longitudinal prominence formed by the urethra and the continuation of the raphe of the perinæum (2893). This prominence is bounded on each side by a shallow groove.

The *two sides* of the penis are rounded. Its *posterior extremity* or *root* is connected with the walls of the pelvis. Its *anterior extremity* is free, and presents the glans, the prepuce, and the orifice of the urethra.

b. ORGANIZATION OF THE PENIS.

2922. The penis is formed by the *corpora cavernosa*, the principal seat of erection; the *urethra*, destined for the transmission of the semen; *corpus spongiosum urethræ*, terminated by the *glans;* by *vessels, nerves*, and a *cutaneous envelope* which gives rise to the *prepuce.*

1. OF THE INTEGUMENTS OF THE PENIS, AND OF THE PREPUCE.

2923. The skin of the penis is continuous with that of the scrotum and pubes. It is thin, less white than that of the other regions of the body, furnished with a great number of sebaceous follicles, especially at the lower part of the organ, and surmounted posteriorly with a few hairs whose extremity is turned forwards, it has below it a layer of cellular tissue, very loose at first, but which becomes dense, whitish, and as if membranous in proportion as it is examined nearer the corpus cavernosum. This tissue never contains fat. It is manifestly continuous with the suspensory ligament of the penis and with the septum of the dartos. It is traversed by a very great number of veins and nervous filaments.

2924. At the free extremity of the penis, the skin forms a more or less considerable prolongation, terminated by an aperture varying in width in different subjects. This is the *prepuce*, the use of which is to envelope and protect the glans.

2925. The prepuce appears composed of two membranous layers, between which is a plane of cellular tissue. The external layer is formed by the skin which we have just described. The internal which is of a mucous nature, lines the inner surface of the cutaneous prolongation, ascends a little beyond the glans, and is reflected over the latter, forming behind its base a small cul-de-sac applied against the corpus cavernosum. This cul-de-sac is interrupted, beneath the orifice of the urethra, by a fold which is named the *Frenum preputii*, and which, placed in the inferior groove of the glans, frequently ascends to the aperture of the urethra.

The cutaneous layer of the prepuce is very fine and entirely destitute of hairs. Its mucous layer, from being at first very pale, becomes of a rather intense red as it approaches the base of the glans. There it covers two or three rows of sebaceous, whitish, rounded follicles, of the size of a mustard seed, more or less prominent, and which furnish a thick, unctuous humour of the consistence of butter and of a very fetid smell, which collects between the glans and prepuce.

The cellular tissue intervening between these two membranous layers has the greatest resemblance to that of the scrotum. It is extremely loose, and allows the skin to slide upon the mucous membrane. It very readily permits the infiltration of serous fluid.

2. OF THE CORPUS CAVERNOSUM.

a. GENERAL CONFORMATION.

2926. The *Corpus cavernosum* almost of itself determines the dimensions of the penis, and forms about two-thirds of its volume. It embraces the urethra, and extends from the anterior and internal part of the sciatic tuberosities as far as the substance of the glans.

Many authors describe two corpora cavernosa in the penis, but there only exists one, as MM. Salvatier, Chaussier and Roux have demonstrated. There are distinguished in it two roots, an anterior extremity, and two surfaces.

2927. The *Roots of the Corpus cavernosum* are attached to the inner edge of the rami of the ossa ischii and pubis, and are covered internally by the ischio-cavernosi muscles. About two inches in length they commence at the fore part of the sciatic tuberosities by a very slender extremity, and unite before the lower part of the symphysis of the pubes. The triangular space which separates them from each other is filled by fat and by the urethra.

2928. The *anterior extremity* of the corpus cavernosum represents a truncated cone, united to the base of the glans, and perforated by several apertures for the passage of vessels.

2929. Its *upper surface* is marked with a longitudinal and shallow groove, in which creep the dorsal artery and veins of the penis. At its backmost part, it gives attachment to the *Suspensory Ligament of the Penis,* a fibrous, triangular, tranversely flattened bundle, which sometimes presents vestiges of muscular fibres, and which is attached on the other hand to the lower part of the symphysis of the pubes.

2930. Its *inferior surface* presents a broad groove, deeper than that of the upper surface, and which receives the upper part of the corpus spongiosum urethræ, to which it is attached by a filamentous cellular tissue.

b. ORGANIZATION OF THE CORPUS CAVERNOSUM.

2931. The corpus cavernosum is essentially composed of a fibrous and very strong external membrane, and of an internal spongy tissue, the intimate nature of which is not yet very well known.

2932. *Fibrous Membrane.* It is in general very elastic, very thick and very strong, excepting however upon its roots, in the groove which receives the urethra, and at the extremity which sustains the glans, in all which places it is traversed by a multitude of vascular ramifications. Its general colour is opaque white, excepting in the parts just mentioned, where it appears more or less livid. Its fibres are for the most part longitudinal. They are interlaced posteriorly with the periosteum of the ossa ilii and the aponeuroses of the muscles which are attached to the lower edge.

2933. The cavity of this fibrous membrane is divided into two lateral portions by an incomplete middle partition, *(Septum pectiniforme,)* which commences before the symphysis pubis, but is not prolonged as far as the glans, presenting in its anterior third only a few flattened fibrous fasciculi, separated by intervals of greater or less breadth.

2934. *Spongy Tissue.* This tissue, which fills the whole cavity of the fibrous membrane, seems to be a very complicated lacework of arterial and venous vessels, of filaments probably nervous, and of small fibrous laminæ, which by crossing each other, form a multitude of cellules, which all communicate together, and in which there is also found a greater or less quantity of blood. An injection made by the cavernous artery penetrates into these cellules; and if they are distended with air, it passes into the cavernous vein, so that we may, to a certain degree, consider them as intermediate between the arteries and the veins. The filament which enter into the composition of this tissue are very distinctly continuous with the fibrous membrane.

2935. The arteries of the corpus cavernosum (2529) come from the upper branch of the internal pudic, and occupy the centre of its lateral portions. They have frequent anastomoses with each other, and communicate with the arteries of the glans and urethra. Its veins follow the same course as the arteries; but their volume is much larger. The nerves have not yet been fully traced in the spongy tissue of this organ.

3. OF THE URETHRA.

a. GENERAL DISPOSITION.

2936. The *Urethra*[*] is the excretory duct of both the urine and semen. It is from nine to twelve inches long, extends from the neck of the bladder to the extremity of the penis, where its external orifice occurs, is bent several times in the direction of its length, and in such a manner as to represent a kind of S, and has a large capacity, which much exceeds that of all the other excretory ducts. Its walls are partly spongy, partly membranous, and it receives in its course, the ejaculatory ducts and those of the prostate gland, of

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[*] Ουρηθρα.

Cowper's glands, and of a multitude of mucous follicles. The external diameter is not the same in its whole length.

At first directed a little obliquely forwards and downwards, the urethra traverses the prostate gland. On emerging from that body, it passes beneath the inferior extremity of the rectum, under the symphysis pubis, ascends before the latter part, between the two roots of the corpus cavernosum, places itself in the groove of the lower surface of the latter organ, and terminates at the summit of the glans by a vertically elongated aperture. This second part of the urethra changes its direction according to the state of the corpus cavernosum.

2937. From the difference of disposition and structure which this canal presents in the different parts of its extent, it is divided into three portions, as follows:

1. A *prostatic portion*, near the bladder, situated above the inferior extremity of the rectum, at about an inch from the anus and perinæum, and from fifteen to eighteen lines in length. It passes obliquely through the prostate gland, the tissue of which sustains its walls, which are extremely thin. It has the figure of a cone having its summit directed forwards, and is intimately attached to the intestine by cellular tissue and by the recto-vesical aponeurosis.

2. A *membranous portion*, only from eight to ten lines in length, connected with the rectum by dense cellular tissue below and behind; it approaches anteriorly the inferior region of the symphysis pubis and the anterior fibres of the levatores ani muscles. It rests upon the vesiculæ seminales, and is connected with them by an aponeurotic lamina. In this portion of its extent, the urethra is contracted, and its walls are also thin. In this place there occur between it, the bladder and the symphysis pubis, large veins and loose cellular tissue.

3. A *spongy portion (corpus spongiosum urethræ)* which expands anteriorly to form the glans. It commences posteriorly before the inferior extremity of the rectum, to which it is attached partly by means of the sphincter ani, by a bulging called the *Bulb of the Urethra*, which is placed immediately under the angle of union of the roots of the corpus cavernosum, above the two bulbo-cavernosi muscles and the skin, between Cowper's glands, and insensibly loses itself anteriorly in the rest of the spongy tissue. This portion of the canal is afterwards in relation inferiorly with the septum of the dartos and skin. Its upper part is lodged in a groove of the corpus cavernosum (2930).

2938. Considered as to its anterior, the urethra has not the same breadth in its whole course. From being pretty wide at the moment of its commencement, it presently contracts, and again dilates in the centre of the prostate gland. The membranous portion which comes next is much narrower than any other part of the canal, which is wider from the bulb to the base of the glans. There, immediately before opening, it becomes the seat of a very decided dilatation, which is named the *Fossa navicularis*, and is finally contracted at its orifice.

2939. There are observed in the interior of the urethra and in the whole length of that canal, two median whitish lines, the one superior, the other inferior. There are also observed, but in the membranous and spongy portions only, some longitudinal wrinkles which are effaced when the mucous membrane which forms them is distended, and which does not dive into the fossa navicularis.

2940. The inferior median line ends posteriorly at an oblong prominence, about an inch long, rounded and continuous behind with the *Verumontanum (Caput Gallinaginis.)* This prominence is formed by the mucous membrane, and contains in its most retired part a vast lacuna. Anteriorly, it becomes thin and ends in a point. The oblique orifices of the ejaculatory ducts (2920) are placed upon its sides, those of the prostate gland are seen at its surface (2918), arranged in the form of a semi-circle, and anteriorly, those of Cowper's glands. All these orifices are entirely destitute of valves. Sometimes only the summit of the ridge is drawn back upon itself so as to cover with a kind of prepuce the aperture of the ejaculatory ducts.

b. ORGANIZATION OF THE URETHRA.

2941. In its whole extent, the urethra is lined by a mucous membrane, which is backed, in its first two portions, by a cellular membrane, and in the last, by a layer of a soft and spongy tissue.

2942. *Mucous Membrane.* It is continuous, on the one hand, with that which covers the glans, and on the other, with the inner coat of the bladder (2899), and with the membranes which invest the ejaculatory and prostatic ducts, &c. It does not adhere firmly to the subjacent parts, excepting towards the glans and in the prostate. Its colour varies according to the different parts where it is examined, being of a bright red near the external orifice, very pale and whitish in the rest of its extent. It is folded upon itself in the direction of its length, and furnished with a multitude of small holes which are the orifices of the oblique ducts placed in its substance, and which are named *Sinuses of Morgagni.* These ducts appear to be lacunæ, for they are not seen to proceed from follicles, as is the case in many other mucous membranes. They begin to exist opposite the bulb, and become more and more abundant as far as the fossa navicularis.

The mucous membrane of the urethra is very delicate, so as not to be distinguishable from epidermis. It is traversed by a great number of very minute blood-vessels.

2943. *Cellular Membrane.* It seems to arise from the white tissue peculiar to the neck and triangular space of the bladder (2887), and at first separates the mucous membrane from the tissue of the prostate gland. Opposite its membranous portion, it acquires considerable density, and is strengthened by the fibres of the levatores ani, bulbo-cavernosi, transversi perinæi and sphincter ani muscles.

2944. *Spongy Tissue.* It surrounds the three anterior fourths of the length of the urethra. It commences by forming the bulb, then diminishes in thickness and constitutes a uniform and cylindrical layer as far as the glans. Beneath the fossa navicularis, it becomes thin in a remarkable degree, and collects above and behind to form the glans by expanding. It is attached to the corpus cavernosum by a great number of blood-vessels which it receives from that part, and by a lamina of its fibrous membrane. The cellules of this tissue are pretty large in the glans, but very small in the rest of its extent.

From microscopical observations recently made, it would appear that this tissue contains fasciculi of longitudinal muscular fibres, which are very short, interlaced together and united by their extremity and origin. The thickness of this kind of fleshy layer is greater at the upper part of the penis than at the lower, and towards the external orifice of the canal than elsewhere.

2945. The arteries of the urethra are numerous and come particularly from the internal pudic. The largest branches penetrate into the bulb (2529). Its veins follow the course of the arteries, and its lymphatic vessels go to the inguinal and hypogastric plexus. Its nerves come from the pudic (1765) and inferior glutæal (1764).

4. OF THE GLANS.

2946. The *Glans (Balanus)* of the penis, which is continuous with the urethra and forms the extremity of the penis, presents itself under the appearance of a cone slightly flattened in the same direction as the corpus cavernosum. Its *summit,* which in some individuals is covered by the prepuce and in others free, is perforated by the orifice of the urethra. Its *base*, which has a very oblique direction from above downwards and from behind forwards, embraces the extremity of the corpus cavernosum, and is connected with it by vessels and by a very dense cellular tissue. It is circumscribed by a prominent edge called the *Corona Glandis*, behind which the inner membrane of the prepuce forms a cul-de-sac by being reflected. Beneath the urethra, the corona glandis is interrupted by a small groove which extends to the orifice of that canal, and which is filled by the frenum præputii (2925).

2947. The glans is invested by the mucous membrane of the prepuce, which, over it, is thin, rather dry, destitute of mucous crypts, and covered by a very delicate epidermis. Its internal tissue is spongy, erectile, and of the same nature as that of the urethra, only it appears firmer and denser.

CLASS THIRD.

ARTICLE SECOND.

ORGANS OF GENERATION IN THE FEMALE.

2948. The genital organs of the female form an apparatus at least as complicated as those of the male. Some of them are subservient to the act of copulation, such as the vulva, vagina, &c; others, the uterus and its appendages, are the seat of conception, and retain the product during a determinate time; while others, the mammæ, are subservient to the nourishment of the child after birth.

I.—*OF THE VULVA AND ITS APPENDAGES.*

2946. The name of *vulva* or *Pudendum* is now given to the external parts of generation in the female in general, although this denomination was formerly bestowed solely upon the fissure which exists between the labia and which leads to the vagina.

The vulva is bounded anteriorly at the fore part of the pubes by a prominent surface covered with hair. This is the *Mons Veneris.* Posteriorly, it is only separated from the anus by an interval of an inch, to which the name of *Perinæum* is given. This interval is consequently of much less extent than in the male, and it scarcely presents any trace of raphe (2893). On its sides are observed two elongated eminences, commencing at the Mons Veneris, and uniting posteriorly to form the *Fourchette.* These eminences are the *Labia Pudendi.*

Between the labia, are observed, superiorly the *Clitoris*, a small hard and more or less prominent and elongated body; the *Nymphæ*, a kind of folds which arise from the clitoris and lose themselves upon the inner surface of the labia; the *Vestibule*, a triangular space comprised between the upper parts of the two nymphæ; the *Meatus urinarius* or orifice of the urethra, the *Entrance of the Vagina*, with the *Hymen* or the *Carunculæ myrtiformes;* and lastly between the entrance of the vagina and the fourchette, a small transverse depression termed the *Fossa navicularis*.

1. OF THE VARIOUS PARTS OF THE VULVA IN PARTICULAR.

2950. *Mons Veneris*. This rounded eminence, which is more or less prominent in different individuals, and situated before the pubes, is formed by a mass of fat upon which the skin is immediately applied. It is covered with hairs at the period of puberty. These hairs are not quite so long as those observed on the corresponding part in the male, and also occupy a more limited space, although in some cases they extend to near the umbilicus. Their colour is very variable. They are almost all curled, especially in women who have abused coition.

2951. *Labia Pudendi (Labia majora)*. These are two membranous folds, thicker above than below, whose length is much about the same in all women, but whose volume and projection are in the direct ratio of the degree of fatness of the individual. Their *outer surface* is contiguous to the upper and inner part of the thighs, and is furnished with a few hairs. It is formed by a prolongation of the skin, beneath which there is found a considerable number of sebaceous follicles. The *inner surface* is red and lined by the mucous membrane of the other parts of the vulva. It is smooth and polished. Their *edge* is a little convex, thin or rounded, and is invested by the skin. The interval which exists between the skin and the mucous membrane of the labia pudendi is filled by an adipose tissue similar to that of the Mons Veneris, and traversed by some whitish and fibrous slips. There also occur in it some isolated fibres of the constrictor vaginæ muscles, together with vessels and nerves.

2952. *Clitoris.* * This is a small elongated tubercle, more or less prominent, generally concealed by the labia, and occupying the upper and middle part of the vulva. In some women this organ assumes an extraordinary development, and acquires a length of several inches. Such a conformation is generally in connection with a robust and masculine constitution.

The clitoris has a great resemblance to the penis. Its free extremity forms a kind of rounded and imperforated glans, which is surrounded by a fold of the mucous membrane analogous to the prepuce, and laterally continuous with the nymphæ. Above this glans, is a true corpus cavernosum, attached by its roots, like that of the male, to the rami of the ischia, and sustained, under the symphysis pubis, by a kind of transversely flattened suspensory ligament. This corpus cavernosum has the same structure as that of the penis; only its internal spongy tissue is denser. In proportion to its volume, it receives a great quantity of vessels

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* Κλειτορις of the Greeks.

(2531) and nerves (1768). The latter have anastomoses with all those of the genital parts.

2953. The *Nymphæ*[*] *(Labia minora)*. These are two erectile, elongated membranaceous ridges, transversely flattened, thicker at their middle part than at the extremities, arising to the right and left, from the lateral parts of the prepuce and clitoris, which they separate from each other, situated upon the inner surface of the labia, and terminating towards the middle of the contour of the orifice of the vagina by becoming gradually thinner. Their length varies much. They are sometimes very small, and in some cases are entirely wanting, of which Riolan and Morgagni adduce examples. In some tribes their size is such that they protrude beyond the labia, and require to be cut off.

The nymphæ are formed each by two laminæ of the mucous membrane of the vulva folded upon itself, and contain in their substance a thin layer of an erectile spongy tissue. Numerous vessels also ramify in their substance.

2954. *Meatus Urinarius and Urethra.* In the female the orifice of the urethra is named the meatus urinarius. The urethra in her is very different from what it is in the male, being only an inch in length, much wider, and capable of being dilated to a great extent. It is very wide at its commencement, and descends obliquely forwards to terminate at the lower part of the vestibule, above the orifice of the vagina. In this course, it describes a slight curve, the concavity of which is directed upwards. Its lateral parts and its lower part are in a manner embraced by the upper wall of the vagina. Superiorly, it is in connection with the inferior ligament of the bladder, the symphysis of the pubes, and the corpus cavernosum of the clitoris. The mucous membrane which lines it is reddish, and forms several very prominent longitudinal folds. It presents, especially below, a great quantity of mucous lacunæ. This membrane is enveloped by a thin layer of spongy tissue, and no body similar to the prostate is met with at its exterior.

The outer orifice of the urethra is surrounded by a kind of rim, formed by the mucous membrane of the vulva, and which is always more prominent below than above.

2955. *Entrance of the Vagina.* It is occupied by the hymen or carunculæ myrtiformes.

1. The *Hymen*,[*] the existence of which was long disputed, and which is considered as one of the surest signs of virginity, is a more or less distinct replication of the mucous membrane of the vulva at the moment which it penetrates into the vagina. Its form is extremely variable, being semilunar, parabolic, or circular, nor does it in general close the canal in an accurate manner. Sometimes, however,

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[*] Νυμφαι of the Greeks, because they were supposed to direct the stream of the urine, and to preside over its emission, as the Nymphs over fountains.

[†] Ὑμὴν, *membrana.*

it has been seen to form a complete septum, preventing coition and the flow of the menstrual fluids. Its thickness varies as much as its form and breadth. A few vascular ramifications are seen in it.

2. The *Carunculæ myrtiformes* are small reddish tubercles, rounded or flattened, and more or less prominent, which are only observed in women who have lost their virginity, and which are usually considered as the remains of the hymen, lacerated by the introduction of the penis into the vagina, or by child-birth. Their number is indeterminate, and varies from two to five or six. Their colour and consistence are different in different subjects; so that they may be seen of a vermillion red, livid or pale, firm or flabby.

2956. The *Vestibule*, *Fossa navicularis* and *Fourchette* do not require any particular description.

2. OF THE MUCOUS MEMBRANE OF THE VULVA IN GENERAL.

2957. This membrane, which extends over all the parts which compose the vulva, and which of itself forms several of them, arises upon the free edge of the labia, invests their inner surface, becomes folded to produce the nymphæ, surrounds the clitoris with a particular prepuce, lines the vestibule, introduces itself into the urethra by the meatus urinarius, and ascends in the vagina, forming at the commencement of that canal the hymen or the carunculæ myrtiformes.

It is attached to all these parts in a rather loose manner, especially towards the sides of the clitoris. It is of a vermillion red in virgins and young women, and becomes livid in those who are advanced in age, who have had children, or who have abused coition. It is covered by a very distinct epidermis, but which becomes thinner as it retires. It has under it a very great quantity of mucous crypts, the orifices of which are disseminated at the surface of the vulva. These crypts are larger towards the clitoris than on the side next the perinæum.

3. VAGINA OR VULVO-UTERINE CANAL.

a. GENERAL CONFORMATION.

2598. The *Vagina* is a membranous, cylindrical canal, compressed from before backwards, placed in the interior of the pelvis, between the bladder and rectum, opening inferiorly at the middle of the vulva, and embracing superiorly the neck of the uterus. From six to eight inches long, slightly curved upon itself, and concave on the side next the bladder, shorter before than behind, somewhat narrower at its two extremities than at its middle part, the vagina is directed a little obliquely from above downwards, and from behind forwards, or is almost vertical.

2959. *Outer Surface.* Anteriorly and posteriorly, it is invested above by the peritoneum over a very small extent. Anteriorly and inferiorly, it is in contact with the bladder and urethra. Posteriorly and inferiorly, it rests upon the rectum. It is connected with these different organs by a rather dense cellular tissue. On the sides, it corresponds above to the broad ligaments of the uterus, and below to a mass of cellular tissue which separates it from the levatores ani muscles, and in which creep the uterine and vesical vessels, and the umbilical artery.

2960. *Inner Surface.* The walls of the cavity of the vagina are in contact with each other in their ordinary state, and invested with a more or less thick layer of mucus. Its cavity is dilated in the ratio of the number of births and the frequency of coition.

The anterior wall is intersected longitudinally and in the middle by a narrow and elongated ridge, more distinct on the side next the vulva than near the uterus. In the former direction it even frequently forms a pretty prominent tubercle beneath the orifice of the urethra. On the posterior wall a similar but less apparent ridge is observed. These two walls present, moreover, a great number of transverse wrinkles, which are effaced on the sides, and which are much more prominent and more numerous in the vicinity of the vulva than near the uterus, where they follow all sorts of directions. All these rugæ are intersected at right angles by the two longitudinal ridges of which we have spoken, and are entirely formed by the mucous membrane which lines the canal.

2961. The *upper extremity of the Vagina* is fixed around the upper part of the neck of the uterus, a little higher behind than before. The *lower extremity* forms in the vulva a fissure elongated from above downwards, and from before backwards.

b. ORGANIZATION OF THE VAGINA.

2962. The vagina is lined by a mucous membrane, around which there are observed a layer of erectile spongy tissue, and another cellulo-vascular membrane. A constrictor muscle (1076), together with numerous vessels and nerves, also enters into the composition of this organ.

2963. *Mucous Membrane.* It is evidently the continuation of that of the vulva, and is equally continuous with the mucous membrane of the uterus. Inferiorly it is of a bright red colour, becomes whitish or grayish above, and posteriorly often presents irregular bluish or livid spots. Between the rugosities of which we have spoken above, it is perforated with a great number of pores, which are the orifices of its mucous follicles, or rather of its lacunæ. Its thickness diminishes in proportion as it retires in the vulva towards the neck of the uterus. In some places it has a nearly cartilaginous consistence. In its whole extent, it is invested by a very distinct epidermis.

2964. *Erectile Spongy Tissue.* It forms around the inferior part of the vagina a layer about an inch broad and two or three lines thick. It has a grayish colour and a dense and compact texture. No regularly disposed fibres are distinguished in it. Superiorly, it becomes very thin, but it nevertheless ascends as far as the uterus, and seems to be continuous with the proper tissue of that organ. It is commonly designated by the name of *Plexus retiformis.*

2965. The vagina receives an artery which arises from the hypogastric (2388). Its nerves are furnished by the sciatic plexus (1733).

II.—*OF THE UTERUS OR WOMB AND ITS APPENDAGES.*

1. OF THE UTERUS.

a. GENERAL DISPOSITION.

2966. The *uterus* or *womb*, which is destined to lodge the fœtus from the period of conception to that of birth, is a hollow, symmetrical organ, pyriform or rather of the shape of a truncated cone, placed in the middle of the pelvis, between the bladder and rectum, above the vagina and beneath the inferior circumvolutions of the small intestine. It is flattened from before backwards, and is nearly an inch in thickness. From being about two inches broad in its highest region, it contracts towards the vagina, and terminates by a narrow elongated portion which is called the *neck*, to distinguish it from the rest of the organ, which is named its *body.*

2967. *Body of the Uterus.* It is somewhat less than two inches in length. Its two surfaces are convex, the anterior however a little more so than the posterior, and invested by the peritoneum. The former is in contact with the bladder, and the latter with the rectum. Its lateral edges are convex, directed downwards, forwards and inwards. They correspond to the interval of the two laminæ which compose the broad ligaments. Its upper edge is rounded, transverse, a little convex in the direction of its length, and lined by the peritoneum. By its union with the lateral edges, it produces two slightly projecting angles, in the middle part of which terminate the Fallopian tubes, above the insertion of the ligament of the ovarium which is behind, and of that of the round ligament which is before.

2968. *Neck of the Uterus.* It is almost insensibly continuous at the exterior with the body. Its length is from fourteen to twelve lines, its antero-posterior diameter from six to eight, and the transverse from eight to ten. Slightly inflated at its middle part, it is compressed from before backwards and of a somewhat cylindrical form. Its upper part is embraced by the vagina; the rest descends projecting into the fundus of that canal. This latter portion, which is more or less prominent, is commonly called the *Os Tincæ.* It presents at its summit a transverse slit bounded by two rounded lips, placed close to each other, and distinguished into anterior and posterior. The latter is always thinner than the other. Both are smooth and rounded in women who have not had children, and on the contrary wrinkled and as if lacerated in those who have been repeatedly brought to bed.

2969. *Cavity of the Uterus.* This cavity is very small in proportion to the volume of the organ, which necessarily supposes a great thickness of wall. It occupies the body and neck, and terminates inferiorly at the slit of the os tincæ. The portion of this cavity, which corresponds to the body, is triangular and flattened. Its edges are curvilinear, and its upper angles present the extremely minute orifices of the Fallopian tubes. Each of its surfaces is longitudinally traversed by a line which does not project much.

The cavity of the neck is continuous with that of the body. It is nearly cylindrical, a little compressed however from before backwards, and slightly dilated before opening into the vagina. It presents, upon its anterior and posterior walls, the continuation of the prominent vertical lines of which we have just made mention, together with some scarcely perceptible transverse rugæ.

b. ORGANIZATION OF THE UTERUS.

2970. The uterus is composed of an external or serous membrane, an internal mucous membrane, an intermediate proper tissue, nerves and vessels.

2971. *Serous Membrane.* It is formed by the peritoneum, which, from the anterior surface of the rectum and the posterior surface of the bladder, is reflected over the uterus, to which it forms an envelope adhering pretty firmly along the upper edge, but separated from the tissue of the organ upon the two surfaces by a great quantity of vessels and by a layer of dense cellular tissue, destitute of fat.

2972. *Mucous Membrane.* It is a prolongation of that of the vagina; but such is its tenuity, that many anatomists doubt its existence, and its intimate adherence to the tissue of the organ still adds to this doubt. It sends into the Fallopian tubes two prolongations which we shall subsequently examine. Its colour is white, very slightly tinged with red. This latter tint is especially manifest some days before and during menstruation. It is covered with a great number of very fine villosities, and presents the orifices of some mucous crypts, which are more abundant towards the neck than elsewhere. Frequently also the crypts dilate in that place, and assume the form of small semitransparent vesicles projecting into the interior of the uterus. An old author, Naboth, took them for eggs, and for this reason these small bodies are sometimes designated by the name of *Ova of Naboth.* No excretory ducts have as yet been discovered for these vesicles.

2973. *Proper Tissue.* It occupies the interval which separates the peritoneum from the mucous membrane. Its thickness is great and amounts to five or six lines. It is of a dense and close texture, and yields great resistance to the knife. It is elastic and of a grayish white colour. Its adhesion to the mucous membrane is very great. Its intimate nature is yet little known. It is traversed by a very great number of blood-vessels. It is impossible to distinguish in any part of its extent, the disposition of the fibres of which it is composed. Towards the neck, it is denser and less gray than in the walls of the body. It would appear, that during gestation, this tissue becomes truly muscular.

2974. The arteries of the uterus come from the spermatic and hypogastric. Their principal branches are placed beneath the peritoneum; they are very flexuous, and anastomose frequently together. Its veins follow the same course, but are still more flexuous, and form cavities in its walls which become very large during gestation, and which are called *Uterine Sinuses.* Its nerves come from the sciatic and hypogastric plexus. Its lymphatics are very numerous, and during gestation acquire enormous dimensions.

2. OF THE FOLDS OF THE PERITONEUM NAMED THE BROAD LIGAMENTS.

2975. These folds, improperly called ligaments, are placed in the excavation of the pelvis, and form with the uterus and upper part of the vagina a kind of transverse septum which divides that cavity into two parts, an anterior for the bladder, and a posterior for the rectum. They are continuous by the inner edge with the peritoneum which invests the two surfaces of the uterus, and externally are expanded upon the sides of the excavation of the pelvis. They are formed of two laminæ placed back to back, in the interval of which is contained cellular tissue rarely containing fat. It is also between these two laminæ that there are placed, on each side and superiorly, the Fallopian tubes, then beneath, anteriorly, the round ligament, and posteriorly the ovary. The tube occupies the free edge of the ligaments; the other two organs raise each of their surfaces angularly, and thus form two smaller folds which are named *little wings.*

3. OF THE ROUND LIGAMENTS.

2976. The *Round Ligaments (Cordons sus-pubiens)* arise from the lateral, superior and anterior part of the uterus, beneath and before the insertion of the tubes. They direct themselves from thence towards the inguinal ring, pass through it, and terminate by expanding in the cellular tissue of the groins, mons veneris, and labia pudendi.

The structure of these organs is little known. They are whitish, rather dense, flattened, narrower at the middle part than at their extremities. There are distinguished in their substance longitudinal fibres, which for a long time were believed to be muscular, but which appear to be nothing but condensed cellular tissue. Many tortuous vessels creep among their fibres. Fallopius asserts that these cords are enveloped by a kind of cremaster muscle, but I have never been able to see this disposition.

4. OF THE FALLOPIAN OR UTERINE TUBES.

2977. The *Fallopian Tubes (Tubæ uterinæ sive Fallopianæ)* are two canals floating in the abdomen and placed along the upper edge and in the duplicature of the broad ligaments. They extend from the upper angles of the cavity of the uterus to near the sides of the upper strait of the pelvis, and are thus four or five inches in length. In the inner half of their length, they are straight and of very small diameter, for they scarcely equal the vas deferens at its commencement. They afterwards acquire the size of a writing quill, and become flexuous. A little before terminating, they contract again and seem strangled. Their free extremity is wide, floating, and fringed. It is called the *Morsus Diaboli* or fimbriated extremity of the tube. Among the fimbriæ of this part, one is observed, a little longer than the rest, which goes to attach itself to the corresponding extremity of the ovary. The surface of the fimbriated extremity of the tube is generally directed backwards.

2978. In their interior, the Fallopian tubes contain a canal which commences at the upper angle of the cavity of the uterus. Almost capillary in its first half, it afterwards dilates and opens at the surface of the fibriated extremity by a very small orifice, the only place in the whole body where a serous membrane communicates with the exterior. In this cavity, there is generally found a considerable quantity of mucous fluid; but no valves are ever seen in it.

2979. The Fallopian tubes are internally lined by a mucous membrane still thinner than that of the uterus. It is soft, reddish, and slightly villous, and presents several longitudinal plicæ. No mucous follicles have hitherto been discovered in it.

2980. Externally, these organs are formed by a very thin layer of a spongy and erectile tissue, similar to that of the urethra, and invested by the peritoneum.

3. OF THE OVARIES.

2981. The *Ovaries (Ovaria)*, which for a long time were called the *Testicles of the female,* are two egg-shaped bodies, a little smaller than the testicles, placed in the substance of the broad ligament, between the Fallopian tube and the round ligament. They are compressed from before backwards, of a pale red colour, and wrinkled and rough at their surface, which often presents a kind of cicatrices. Their outer extremity gives attachment to one of the fimbriæ of the morsus diaboli. The inner is attached to the uterus by a small filamentous cord about an inch and a half long, entirely solid and called the *Ligament of the Ovary.*

2982. The ovary is enveloped by a dense, cellulo-filamentous membrane, the inner surface of which sends a very great number of prolongations into the parenchyma of the organ. This parenchyma itself is soft and spongy. When torn, it appears composed of cellular and vascular lobules, of a grayish colour, gorged with a great quantity of fluid. In the midst of these lobules, are lodged small vesicles to the number of from fifteen to twenty, transparent, of the size of a millet seed, and formed by a very delicate pellicle, in which is contained a viscid fluid, of a reddish or yellowish colour. Around these vesicles the vascular ramifications are more numerous and more minute.

III.—*OF THE MAMMÆ.*

a. GENERAL DISPOSITION.

2938. Before the age of puberty, the *Mammæ,* which are of very small size, scarcely contribute to determine the difference between the sexes; but in the adult and well formed woman, they present themselves on the lateral and anterior part of the chest, between the axilla and sternum, under the form of two hemispherical, somewhat conical, hard and firm eminences, slightly separated from each other, covered by a fine, smooth, semi-transparent skin, softer to the touch and less coloured than that of the rest of the body. No wrinkle or fold is observed upon them in the healthy state.

2984. Towards the central part of each mamma however, the skin is seen abruptly changing its colour and assuming a rosy tint in young girls, or a reddish brown one in women who have suckled several children. This circle of the skin, where the latter is remarkable for its extreme tenuity, presents however a wrinkled appearance owing to the presence of sebaceous glands, and is called the *Areola* of the *nipple.* These glands, whose number varies from four to six, are irregularly disseminated over the whole areola, or form a regular circle near its circumference They present near their summit, two, three, or four small apertures, the orifices of their excretory ducts. They seem destined to furnish an unctuous fluid calculated to protect the nipple against the action of the saliva of the child.

2985. In the middle of the areola rises the *Nipple (Papilla)*, a conical eminence, of a rosy tint, susceptible of a kind of erection during life, and at the surface of which there open the galactophorous vessels. The skin which covers this nipple is wrinkled, reticulated, and furnished with a great number of very fine papillæ. The orifices of the galactophorous ducts, which are observed at its surface, are surrounded by excessively minute hairs.

b. ORGANIZATION OF THE MAMMÆ.

2986. Besides the skin which covers them, the mammæ are composed of a layer of more or less thick adipose tissue, a large gland, vessels of different kinds and nerves.

2987. *Adipose Layer.* It is chiefly to this that the organ owes its size and form, and the cellular tissue here appears so much the more impregnated with fat, the larger and softer the mammæ are, for in young girls, where it is firm, little fat is generally found.

2988. *Mammary Gland.* It is placed beneath the adipose layer, before the pectoralis major muscle, and represents a kind of convex cake, with an uneven surface, and an irregularly circumscribed base, especially in women who have suckled several times, and which is prolonged to a greater distance upwards and outwards than downwards and inwards.

The anterior surface of this gland is very uneven. There are observed upon it prominences in the form of ridges and more or less voluminous, and depressions in which are lodged pellets of adipose cellular tissue.

The tissue of the mammary gland results from the assemblage of several lobes of different sizes, and closely connected with each other by dense cellular tissue not containing fat. These lobes are near each other, and more numerous towards the centre than at its circumference. Each of them is composed of several lobules, themselves formed of rounded granulations of a rosy white colour, and of the size of a poppy seed. It is asserted that by means of the microscope, it has been discovered that these grains, themselves so small, are formed by the union of a number of small vesicles.

2989. *Galactophorus* or *Lactiferous Ducts.* The glandular grains just mentioned give rise to the radicles of these canals, which unite into ramuscules, twigs and trunks becoming gradually larger. The latter collect towards the centre of the gland. They are flexuous, very extensile and semitransparent. Those of the different lobes do not communicate with each other, so that there are as many series of vessels as lobes in the gland. They all terminate in sinuses placed near the base of the nipple, and which are commonly from fifteen to twenty-eight in number. These sinuses have not all the same capacity. The largest are two or three lines in breadth, while others are not much larger than the trunks which form them. They are very short, of a conical form, and connected with each other by cellular tissue. From their summits proceeds a bundle of other canals which occupy the centre of the nipple, do not communicate together, and open separately at its surface. All these vessels are destitute of valves. Bichat thinks they are lined by a particular mucous membrane.

2990. The arteries of the mammæ come from the thoracic, axillary, intercostal, and internal mammary. Their deep veins accompany the arteries. Others are subcutaneous and follow a different course. Their nerves are furnished by the intercostal nerves and brachial plexus. Their lymphatics are numerous and form two layers. They communicate with those of the abdomen and thorax, and go to the axillary ganglia.

APPENDIX.

1. OF THE PERITONEUM.*

2991. The *Peritoneum* is a membrane of the order of serous membranes. It is thin and translucid, has a very complicated course, invests the inner surface of the walls of the abdomen, forms several more or less marked folds in that cavity, and is prolonged, under the form of an envelope, over most of the viscera which are contained in it, and which belong to the organs of digestion, of the secretions, and of generation. The peritoneum, therefore, can only be studied with advantage after these organs are known, which is the reason that has induced us to postpone the examination of this membrane until now.

2992. Considered in the male, the peritoneum represents, like all the other serous membranes, a sac, without aperture, whose internal surface, which is to appearance smooth, but in reality covered with very fine villosities, and moistened with serous fluid, is everywhere in contact with itself. In the female it presents at first sight the same disposition; but it is found to be perforated with an aperture opposite the fimbriated extremity of the Fallopian tube (2978), with the mucous membrane of which it seems to be continuous.

2993. To facilitate the simultaneous study of the peritoneum, and of the connections which the abdominal viscera have with it, it is usual to divide the abdomen† into three large zones distinguished into *superior*, *middle*, and *inferior*, and separated from each other by transverse lines, one of which passes under the lower edge of the twelfth rib of each side, while the other extends between the two iliac crests. If we now suppose two other lines, raised vertically from the anterior and superior iliac spine to the level of the lower wall of the thorax, each of these zones will be found divided into three regions, *middle* and *lateral.* Now, the middle region of the upper zone is called the *Epigastrium*,[*] and its lateral regions are named *Hypochondria*;[†] the middle region of the middle zone is the *Umbilicus*, and its lateral region are the *Flanks* or *Sides* properly so called; the *Hypogastrium*[‡] is the middle region of the lower zone, of which the *Iliac Fossæ* constitute the lateral regions. The part of the hypogastrium comprised in the inferior pelvis bears the name of *Pubic Region*, while the name of *Groins* or *Inguinal Regions* is given to the two oblique and angular folds which exist at the point of union of the anterior wall of the abdomen with the upper part of the thighs, and which extend on each side from the anterior and superior spine of the iliac bone to the pubes. The groins are essentially formed by the disposition of the broad muscles of the abdomen.

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* Περὶ, *circa*; τείνω, *tendo.*

† From *abdere*, to conceal, because this cavity contains the principal viscera of the body.

2994. The peritoneum is itself divided, like the cavity of the abdomen, into three portions, of which the middle forms a kind of cincture placed horizontally between the base of the thorax and the iliac crests, and of which the others, the *superior* and *inferior*, represent segments of an ovoid.

2995. *Umbilical Portion of the Peritoneum.* It lines the posterior part of the linea alba, closes the posterior orifice of the umbilicus, and adheres pretty closely, in the circumference of that aperture, to the abdominal aponeurosis. From thence, the peritoneum directs itself horizontally, to the right and left, behind the broad muscles of the abdomen. In the first direction, it meets the ascending colon; in the other, the descending colon; and it forms around these intestines two folds which are named the *Lumbar Mesocolon* (2092, 2094), and which serve to attach them to the posterior wall of the abdomen. At the same time, it passes before the kidneys, from which it is separated by a pretty thick layer of cellular tissue. Then, covering the ureters, the spermatic and renal vessels, the vena cava and the aorta, it advances on each side towards the vertebral column, before which it is reflected from behind forwards, lying upon itself, in order to form the immense fold known by the name of Mesentery (2069).

2996. *Hypogastric Portion of the Peritoneum.* In this part of its course, the peritoneum descends from the umbilicus towards the pubes, and covers the urachus and the two umbilical arteries which raise it a little, so as to make it form three folds projecting backwards, confounded at the umbilical ring, and separated inferiorly. It is then applied against the posterior surface of the recti muscles, and arrives at the upper edge of the ossa pubis, whence it is directed over the summit and posterior region of the bladder. There, it presents differences, according as it is examined, in the male or in the female. In the former, it invests the base of the vesiculæ seminales, and is reflected over the rectum, forming two semilunar folds, separated by a pretty deep cul-de-sac, and called the *Posterior Ligaments of the Bladder.* At the level of these folds, and of their separation, the peritoneum is applied superiorly upon the anterior surface of the rectum; but above it also covers its lateral surface, and constitutes behind it the *Mesorectum* (2107), of which the upper extremity is continuous with the *Iliac Mesocolon* (2049).

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[*] Επί, *supra*; γαστηρ, *ventriculus.*

[†] 'Υπο, *infra*; χονδρος, *cartilago.*

[‡] 'Υπο, *infra*; γαστηρ, *ventriculus.*

In the female, the peritoneum passes from the bladder over the vagina, before which it forms two semilunar folds and an intermediate cul-de-sac, similar to those which in the male, occur between the rectum and bladder, but less distinct. It then invests the anterior surface, the upper edge and the posterior surface of the uterus, and a portion of the corresponding wall of the vagina, prolonging itself to the right and left to form the *Broad Ligaments* (2975). From thence, it gains the rectum, and presents the same disposition as in the male.

The peritoneum then ascends before the sacro-vertebral articulation, and unites with the lamina which forms the mesentery.

We have examined the course of the peritoneum in the middle part of the hypogastric region; let us now follow it upon the sides of that region. It is at first seen reflecting itself from the walls of the abdomen over each iliac fossa, covering a part of the iliac and psoæ muscles, embracing to the left the sigmoid flexure of the colon by means of the *Iliac Mesocolon*, and to the right the cœcum and its appendages by means of the *Mesocœcum* (2086). From thence, it ascends forwards behind Poupart's ligament, and forms two depressions on each side, which are called the *Inguinal Fossæ*, and which are distinguished into *internal* and *external.* These fossæ are separated from each other by the fold of the membrane which the umbilical artery supports. The external, which is wider, is generally triangular. At the bottom of its summit, which is directed downwards and inwards, the peritoneum is seen to dive a little into the internal orifice of the inguinal canal (1090). Posteriorly, the peritoneum, which has invested the iliac fossæ, ascends to be continued into the lumbar mesocolon.

2997. *Epigastric Portion of the Peritoneum.* Of much greater extent, and more complicated than the other two, it exhibits a different disposition to the right, to the left, and in the middle.

1. *To the left*, the peritoneum invests a considerable part of the inferior surface of the diaphragm, and sinks into the most retired region of the hypochondrium as far as the vertebral column, whence it is successively reflected over the posterior surface of the splenic vessels, the posterior half of the inner surface of the spleen, its outer surface, its whole circumference, and the anterior half of its inner surface. There, it meets the splenic vessels a second time near the fissure of the liver, passes over their anterior part,

gains the cardiac extremity of the stomach, and is continued into the anterior lamina of the great omentum. These laminæ of the peritoneum of which we have just been speaking, and which are comprised between the spleen and the stomach, are called *Gastro-splenic Omenta* by many authors.

2. *In the middle*, the peritoneum leaves the diaphragm before its œsophageal aperture, arrives upon the anterior surface of the stomach, passes before the gastro-epiploic vessels, descends to near the most declivous part of the abdomen, and is reflected from below upwards as far as the convex edge of the arch of the colon, thus contributing to the formation of the great omentum. It then invests the inferior surface of the arch of the colon, glides beneath the pancreas and duodenum, forming the inferior lamina of the transverse mesocolon (2093), and is finally continued into one of the laminæ of the mesentery.

3. *To the right*, the peritoneum covers a less extent of the inferior surface of the diaphragm. Arrived upon the posterior edge of the liver, it is reflected upon that organ, forming a fold which has been inappropriately named its *Coronary Ligament*. It covers its whole upper surface, at the middle of which it gives rise to another triangular fold which is its *Suspensory Ligament*. This fold divides the upper surface of the liver into two unequal parts (2793), corresponds on the other hand to the diaphragm, and is continued inferiorly into another fold, which is named the *Falx of the Umbilical Vein*. This fold in fact contains that vein in its substance, and descends anteriorly and to the left as far as the umbilicus.

The right lamina of the so-called suspensory ligament of the liver is then reflected under the concave surface of the great lobe, unites with the rest of the peritoneum along its sharp edge, covers the gall-bladder, and at length forms altogether on the right, a small fold which gains the diaphragm, and which is called the *Right Lateral Ligament of the Liver*. This same lamina leaves the gall-bladder posteriorly, and slips before the duodenum to proceed over the colon.

The left lamina is in like manner reflected under the inferior surface of the left lobe, unites upon its sharp edge with that which lines the upper surface of the liver, and bends, near its posterior edge, to form the *Left Triangular Ligament of the Liver* and the anterior lamina of the *Hepato-Gastric omentum*, and to expand over the anterior surface of the stomach.

2998. *Posterior Cavity of the Omenta*. Immediately under the neck of the gall-bladder there is observed a triangular aperture, the *Foramen or Hiatus of Winslow*, into which the finger may easily be made to penetrate. Through this aperture, there is seen to dive superiorly the lamina of the peritoneum which has formed the anterior lamina of the hepato-gastric omentum, which is applied upon itself, containing in its duplicature the hepatic and pyloric vessels, the coronary vessels of the stomach, and the cystic, hepatic, and ductus communis choledochus. This lamina then directs itself over the whole posterior surface of the stomach, descends behind the gastro-epiploic vessels, applies itself upon the portion of the peritoneum which has embraced the spleen and the anterior surface of the stomach, arrives along with it as far as the inferior edge of the great omentum, and afterwards ascends towards the convex edge of the arch of the colon. It then leaves this first lamina, covers the upper surface of the colon, forming the upper lamina of the transverse mesocolon (2093), and passes above the pancreas and duodenum, the base of the pillars of the diaphragm, the vena cava and the lobulus Spigelii. At length it passes through the foramen of Winslow, and is continued over the concave surface of the right lobe of the liver.

In following this course, the lamina of the peritoneum of which we have been speaking forms the walls of a large ovoidal cavity, the *Posterior Cavity of the Omenta.* It is thus to the peritoneum what the arachnoid membrane is to the portion of that membrane which penetrates into the ventricles of the brain (1492). This cavity, which has no other issue than the foramen of Winslow, is formed anteriorly and from above downwards by the hepato-gastric omentum, the posterior surface of the stomach, the two lamellæ of the anterior lamina of the great omentum. Posteriorly, and from beneath upwards, it is formed by the two lamellæ of the posterior lamina of the great omentum, the upper surface of the arch of the colon, the upper lamina of the transverse mesocolon, and its prolongation towards the lobulus Spigelii.

2999. *Organization and General Relations of the Peritoneum.* The peritoneum has precisely the same structure as the other serous membranes which we have already examined. It is in general very thin, although not equally so in all its parts. Its thickness is greater in the loins and behind the anterior wall of the abdomen than any where else. Upon the liver, spleen, stomach, and intestines, and especially in the omenta, the thinness of this membrane is extreme.

Nor is its adhesion to the organs which it invests uniform in all parts. It is very decided upon the liver, spleen, and intestines, with the exception of the duodenum ; but is much less so upon the pancreas, bladder, uterus and vagina, as well as upon the diaphragm and the walls of the abdomen, which is especially remarkable in the lumbar regions and before the kidneys. In general, at the level of these different parts, in the excavation of the pelvis, the peritoneum has beneath it a great quantity of adipose cellular tissue. It also contains much of that substance in the different folds which it forms, as the mesentery, mesocolon, &c.

2. OF THE OMENTA OR EPIPLOA.[*]

3000. *Hepato-gastric Omentum.* This is a fold of the peritoneum, with which we are already acquainted, and which extends transversely from the right side of the cardia to the corresponding extremity of the transverse fissure of the liver, and from above downwards, from the inferior surface of the diaphragm to the pylorus and duodenum. It is under it that the foramen of Winslow occurs, and between its two laminæ that the biliary and hepatic vessels are lodged. It contains in general a little fat.

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[*] Επι, *upon ;* πλέω, *to float.*

3001. The *Great Omentum* is a very large fold, free and floating upon the circumvolutions of the intestine. It is irregularly quadrilateral, and more commonly on the left side than on the right. Its base is attached anteriorly to the great curvature of the stomach, and posteriorly to the arch of the colon. Its edges are continuous above, the one with the colic omentum, the other with the gastro-splenic omentum, and farther down with the neighbouring portion of the lumbar colon.

It is formed of two laminæ, each composed of two lamellæ, the one superficial, the other deep. The two lamellæ of the anterior lamina leave between them and the great curvature of the stomach a triangular space (2059); but they are afterwards confounded, and ascend together to form the posterior lamina. At the upper part of this latter, they separate again to embrace the arch of the colon, and form the transverse mesocolon. The one joins the mesentery, the other ascends towards the foramen of Winslow.

There is found in the substance of the great omentum a very large quantity of vessels and fat, the latter generally having flakes dispersed through it.

3002. *Colic Omentum.* This is a fold of the peritoneum which exists only on the right side, and which is placed behind the great omentum. It nearly fills the angle formed by the union of the right and transverse portions of the colon. Sometimes it extends as far as the cœcum or towards the spleen. Its two laminæ are separated by arteries and veins belonging to the colon.

3003. The *Gastro-splenic Omentum* is formed by the peritoneum, which, from the edges of the fissure of the spleen, proceeds over the cardiac extremity of the stomach. It contains in its substance the splenic vessels and vasa breviora.

3003. Besides the omenta, the peritoneum forms other folds, such as the mesentery, the mesocolon, the mesorectum, the mesocœcum, the broad ligaments of the uterus, the suspensory ligaments of the liver, the adipose appendages of the large intestine, &c. These, however, have already been described.

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ERRATA.

Page 13, second line from bottom, insert after *several bones*, *Clefts*, or *fissures*, *if they are longitudinal and very narrow*.
—— 29, eighteenth line from top, after *serratus magnus*, insert *serratus posticus superior*, *serratus posticus inferior*.
—— 39, thirteenth line from top, for *and is itself surmounted by*, *&c.* read *and does itself surmount*.
—— 44, fifteenth line from top, after *frontal bone*, read *below with the palate and superior maxillary bones*.
—— 46, fourteenth line from bottom, for *side*, read *third*.
—— 48, sixteenth line from top, after *small*, read *anterior*.
—— 48, seventeenth line from top, after *form*, read *nearly horizontal*.
—— 48, thirteenth line from bottom, for *externis capitis*, read *capitis lateralis*.
—— 51, eleventh line from bottom, for *inwards and outwards*, read *from within outwards*.
—— 52, twenty-third line from top, for *wider*, read *narrower*.
—— 53, seventeenth line from top, for *the Fallopian tube*, read *the aqueduct of Fallopius*.
—— 53, twenty-third and twenty-fourth lines from bottom, delete *which is the entrance of the Fallopian tube*.
—— 53, twenty-second line from bottom, for *about two thirds*, read *about the two posterior thirds*.
—— 53, nineteenth line from bottom, after *nerve*, insert *and which is the entrance of the aqueduct of Fallopius*.
—— 53, thirteenth line from bottom, for *canal*, read *aqueduct*.
—— 53, third line from bottom, for *external*, read *internal*.
—— 54, eighth line from top, for *brain*, read *cranium*.
—— 57, eighteenth line from top, for *angle*, read *edge*.
—— 57, twenty-first line from top, for *temporal*, read *occipital*.
—— 58, eighth line from top, for *Case*, read *base*.
—— 66, thirteenth line from top, for *long*, read *osseous*.
—— 126, twenty-sixth line from bottom, for *major*, read *minor*.

Plane sometimes occurs for *plain*. The reader will judge when it is required to be altered.

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